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THE COLLEGE BOARD AND THE HIGH SCHOOLS

JUVENILE DELINQUENCY AND CALIFORNIA HIGH SCHOOLS

PREPARATION IN HIGH SCHOOL FOR SUBJECT A

CURRENT EVENTS AND MATERIALS IN JUNIOR COLLEGE EDUCATION

A SYMPOSIUM
TOWARD EXCELLENCE IN HIGH SCHOOL SCIENCE

Next Month a Symposium on
REFORMING HIGH SCHOOL FOREIGN LANGUAGES

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A SYMPOSIUM NEXT MONTH ON
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FOREIGN LANGUAGES

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EDITORIAL

CLARITY OF AIM FOR THE AMERICAN HIGH SCHOOL

The American high school today faces the dual but seemingly contradictory task of (1) assuming a much larger educational responsibility than ever before, and (2) more sharply focusing itself upon the intellectual component of human development. How is it possible at once to embrace a larger responsibility and at the same time to define more precisely the aim of the high school?

From all sides comes a call for more serious attention to intellectual matters in high school. A growing conviction among us is that the central purpose of the secondary school is to develop fully in each pupil his capacity to make wise choices and to display the discipline necessary to follow through even in the face of obstacles. Youth need the capacity to choose and the stamina to follow the best, not the easiest, path. The making of rational choices is essentially an intellectual task, in which the student, with a well-informed mind, uses his knowledge logically to think through new and difficult situations. This has been called by some "problem solving." A person with this capacity does not drift. His is an active, vigorous, independent, searching mind, not a submissive, inert, *tabula rasa* upon which any external force may write whatever it pleases.

More pointed attention to the intellectual function of the high school does not mean that the physical, emotional, and social components of human personality should be neglected. That all of these require development in harmony for the fullest functioning of any human being is one of the most significant conclusions of modern psychological study. In time of stress, however, unique and essential functions must prevail over less central ones. The enduring historical function of the school that no other institution is so well designed to perform, is its intellectual one.

For a period of time, the school in America widened its scope. This earlier devotion to broadened functions and activities did not mean, as some critics today argue, that the schools were led up a primrose path by a malevolent minority of educationists and Deweyed philosophers. A devotion to wider goals by American schools was possible and needed in the development of this country and is not unrelated to its rapid climb to the pinnacle of world prominence. But one great advantage in a democratic pluralistic society is the capacity of its institutions to modify aims and programs as circumstances require. It appears clear that the American high school is well on its way to concentrate even more seriously upon the large intellectual task which confronts it.

One reason that the high school can now turn more attention to intel-

lectual operations is a resurgence of family life and of the church, both of which should assume a larger share of their traditional moral and character training duties. Furthermore, other community agencies and groups, such as those responsible for law enforcement, health, and recreation, have become more fully developed. They not only can but should be called upon to perform their proper role, rather than to slough off duties onto an already overcrowded school.

A pointed example is one of the most recent additions to the high school curriculum, namely, teaching youth to drive an automobile. As Frank Lindsay noted in the October 1958 issue of the *Journal*, educators did not seek this. Even though they wisely insisted upon additional financing, an added burden and expense was placed upon the high school. With a larger, more challenging, and critically important task confronting education in a time of teacher shortage and stringent financial conditions, priorities become inescapable. First things must come first. As vital as is teaching youth to drive safely, should the school do this when good teachers and money are in short supply, and where lack of time prohibits sufficient attention to the basic scientific and humanistic studies of mathematics, art, music, physics, chemistry, geography, languages, biology, literature? These, unlike driving, are unlikely to be learned beyond the confines of the school. Could not a youth be taught to drive after regular school hours, on his own time, perhaps by law enforcement agencies, such as those represented in the State highway patrol or local police officers, whose natural and normal functions in the community relate to this activity? This would advantageously place law enforcement officers in a more positive relationship with youth. The purpose here is not to attack or enter into a full discussion of the valuable program that has been developed to teach youth to drive safely, but rather to illustrate how we must scrutinize *everything* we are doing in the high school if appropriate attention is to be given to the central task.

Another example may be noted in the field of health. Realizing that it is difficult to teach a child anything if he is malnourished, we embarked upon an elaborate scheme of cafeterias and mass feeding. The school administrator and the board of education thus, in addition to the task of running an educational program, became big restaurant operators. This has taken precious time and energy as well as money for initial outlay and continued operation. A corrective straw in the wind may be seen in the building of some recent high schools where no more than a simple snack bar is provided. Reports are that this more than suffices for the food needs of youngsters, greatly simplifies administration, and substantially reduces expenses.

If other agencies and groups can be made to carry their appropriate share of the responsibilities for the emotional, physical, and social develop-

ment of youth, an already overtaxed school may be able to direct a larger share of its resources to the essential tasks which it alone can do.

While the high school turns its attention more to intellectual accomplishments, it is clear, however, that the American people do not want the schools to train a nation of narrow technicians who know not for what to use their skills, who fail to appreciate non-material values and the intangibles of cultivated living. *The aim which we are setting for our schools is the preparation of persons who are broadly educated and also specialists.* Nothing less will suffice if human beings are to flourish in their own right and if a democratic society is to prosper in the second half of the twentieth century.

This is a new dimension of educational thought, a goal never before attempted for all youth by an educational system. It may be just as revolutionary and just as much a forerunner of things to come as was the idea developed in this country during the last hundred years that high school education should not only be free but also compulsory. Having taken two giant strides forward, in free and compulsory schooling, we may now be taking a third and even more fateful step in defining what the nature of that education shall be. In proclaiming this enlarged goal of breadth and depth in the education of each person, we may be forging another distinctive American contribution to world-wide educational thought.

This is not to suggest that we do not have much to learn from the Europeans and the Russians in educational affairs. Indeed, there is a fortunate disposition for us to be more open-minded than ever before. But it must be noted that their systems tend to run in two distinct patterns, either of training mainly generalists, or mainly technical specialists. Their chief argument centers around the age at which youth should be sorted into two groups, to continue one way or the other. In contrast, we seem to be saying that in the world of today and tomorrow each person by the end of his formal required high school education in the American school system should be well started on the road of his general as well as some form of his specialized education.

This is an enlarged task. It will undoubtedly require a marked increase in efficiency with which the schools are operated as well as substantial increase in financial expenditures; more attention to necessities, less to luxuries and items of secondary importance; greater time and effort from youth; more serious attention by adults to creating a favorable intellectual climate in home and community. The details of realizing this new goal are not the subject of this discussion. They are of such complexity and far-reaching significance as to warrant major attention in the future. The central idea developed here is the change in the dimension of our mission, which has become more comprehensive in one sense and more sharply focused in another.

Out of the current discussion, it appears that clarity and agreement regarding the purpose of the American high school are emerging. If this is so, then the first, most difficult, and indispensable step toward improvement of secondary education in this country has been taken.

R. N. B.

A BETTER SCHOOL IN HURON

School is different this year for eighth graders in Huron, Ohio. For one thing, they don't have time for arithmetic anymore: they're too busy studying algebra or general mathematics. And they're taking a full-scale course in general science besides.

Next year they'll enter high school with 2 full units of credit, ready for biology and geometry. By the time they're seniors, the high school will have added a fifth year of both science and mathematics.

Huron, a town of 5,000 population with a 4-year high school of about 400 students, is quickening its pace in science and mathematics not because it wants all its children to become scientists but because it is thoroughly convinced that school time is precious and must be wisely spent. "We've thought about it this way," says R. L. McCormick, superintendent of schools—and he speaks not only for himself and his teachers but for the school board and the entire community:

"As far back as anyone can remember—as far back as 1885, the records show—we've been holding our high school students down to 4 units of work a year. And all the while we've been accumulating new knowledge in every field and adding new courses to our curriculum—modern languages, home economics, industrial arts, vocational subjects, fine arts. We've finally asked ourselves, what's the point of spreading an educational feast before our students and then putting them into a 16-unit straitjacket so they can't eat?"

No point at all, Huron has decided and has gone on to work out a program that leaves no room for straitjackets of any kind. It's a program that calls for the identifying of all talented children no later than the seventh grade and then "pouring it on"; for offering 6 consecutive years of a foreign language to develop real fluency; for lengthening the school year to 37 weeks and for lengthening the school day from 6 hours to 7 so that students can carry 5 units a year. The longer day and the heavier load were introduced experimentally last year, and the school was pleased to find that most of its students did better work with 5 courses than with 4. Eventually, Huron students will be able to graduate with 24 units of work.

The accelerated science program is getting some extra impetus from community cooperation. Henry M. Miles, a chemist by training and a citizen of Huron, last November heard President Eisenhower's television broadcast urging local communities to strengthen their schools; and the idea came to him of using the knowledge and skills of local scientists and technicians to bolster the school's science program.

—School Life, September 1958

GIVING INDIVIDUAL ATTENTION: The Activities of the College Entrance Examination Board

BY FRANK M. BOWLES*

The College Entrance Examination Board exists within the framework of the problems connected with college preparation and college entrance. Since its present and its future plans are determined by the present and future shape of these problems, I want to consider the problems in general before I turn specifically to the College Board.

First, let me describe as much of the College Board as can be encompassed in one paragraph. It is a non-profit, membership corporation chartered by the University of the State of New York, which is our quaint New York name for a state education department. It has 205 collegiate members and 33 associational members, mostly, though not entirely, associations of secondary schools. These include the California Association of Secondary School Administrators and the California Association of Independent Schools. Although its members pay dues, its real support comes from the candidates who take the tests. Should the rate of increase in recent years continue, we shall test approximately 500,000 candidates in 1958–59.

The first problem of education that we may foresee is the education of

* President, College Entrance Examination Board, 425 West 117th St., New York City, based upon his address to the Spring 1958 meeting of the California Association of Secondary School Administrators in Los Angeles. The plans for the section meeting at which Frank Bowles spoke and the arrangements for him to come to California were made by the California Association of Independent Schools, Howard H. Pattee, Executive Secretary, Box 1211, Los Altos, California.

an ever-increasing percentage of the labor forces. There is nothing particularly startling about this idea. The average amount of education required for admission to the labor force has been increasing steadily since records were first kept in this country. As it has increased, so has the per capita productivity of the labor force increased. There is an obvious connection here. An individual who is educated to perform complex tasks can produce more than an individual educated to perform only simple tasks. Today in America we have virtually eliminated the category that we used to call "unskilled labor." Translated into educational terms, this means that we are in the process of eliminating the category that might be called "uneducated labor." Actually, we are dealing here with the basic factor that has to do with the growth of education. If our colleges and universities today, in 1958, were doing only the tasks they were discharging in 1900, the establishment of higher education would be less than 40 per cent of its present size. Within higher education we would be making no provision for the training of businessmen, the training of nurses, the training of librarians, social workers, or accountants. We would have no junior colleges, no evening programs, and no technical programs. Further new fields will be defined and developed in higher education. We do not know what they will be—we only know they will develop.

The problem is easily translated into concrete terms. The education of a larger proportion of the labor force means simply that an increasing proportion of high school graduates will go to college. There is no necessary point at which this proportion will stop. A few years ago, we were apparently producing sufficient college graduates to meet the needs of the nation when 15 per cent of the age group were going to college. Now we are at the point when over 30 per cent of the age group are in college, but we should take account of the fact that the definition of college has been changing and is not quite the same as it used to be. If the definition of college is still further changed and enlarged by the introduction of new programs of study, and if the new programs of study are introduced at sufficiently low cost, there will be a further increase in the percentage of college-going students. We can anticipate that within twenty years at least half of the age group may be expected to go through what we now call the second year of college. But we can anticipate also that some of these students will take work which will not be of what is now termed "college grade." The percentage of the age group seeking the traditional liberal arts curriculum will probably remain about the same as it is now, which is about the same as it has been for fifty years. This will produce the statistical result that the percentage of college students taking liberal arts will decline as it has been doing for fifty years.

Our second problem in education in the years ahead will be to provide more free or low-cost higher education. The per-pupil cost of higher edu-

cation if accurately calculated, which it has never been, is, like the per-pupil cost of secondary education, much higher than can be borne by a considerable portion of families whose children require schooling. We have long provided free education in the lower grades by distributing the burden across the tax structure, but the tendency in higher education has been to increase the cost to the individual pupil.

As a third problem, we will from time to time undertake to identify new categories of individuals as required and to make special provision for them within our educational structure. The whole history of our education is full of such provision. At one time, in the nineteenth century, considerable effort was devoted to the identification and encouragement of ministers of the gospel and we can still observe that whole segments of our enterprise were given over to this effort. At another time, a tremendous emphasis was placed on the education of physicians; a very needful effort, for medical practice in America once reached a point so low that Alan Gregg of the Rockefeller Foundation once remarked that it was not until about 1910 in America that a random patient with a random illness consulting a physician at random stood better than a random chance of profiting from the encounter.

Much of the current commotion over talent searching is essentially a commotion over past failure to identify individuals in sufficient numbers to supply what has become an important segment of the culture. The commotion is not altogether valid. We actually have at hand much of the information that we need for such talent searching, and a great deal of real identification is going on now. The problem is that we have not always made the best use of that information.

Part of the problem of identifying new categories of individuals and recruiting them into a newly defined area of educational activity is the problem of incentives. Here we seem to be in a fair way at the present time to provide large blocks of incentives to certain categories of students. Setting aside the question of whether or not the incentives, in the form of scholarships, can be administered by existing administrative staffs, we come to the rather more important question of whether the incentives actually work. The answer is probably that they do, but that they tend to be over-used when objectives are important, and that when over-used they do not produce results commensurate with the amount of effort spent upon them. Thus, the large scholarship programs that are now being projected for talent identification and encouragement are likely to be effective only to a limited extent and for a limited time. Specifically five, or ten, or fifty thousand scholarships a year will not add many students to our enrollments. They will merely shift students from low cost institutions to higher cost institutions.

As a fourth problem, we may expect a good deal of curriculum change.

Curriculum in education does change constantly. At the present time, the emphasis on change is felt most severely in the secondary schools which in truth have become vulnerable to criticism by allowing their concern over the socializing mission of education to overcome concern over the equally or more important mission of education, which has to do with the transmission of knowledge.

Because they have become vulnerable, I think there can be no doubt that the secondary school and the college must both reconcile themselves to the fact that we are entering upon another era in which the colleges will be very specific as to their requirements for admission to the freshman class. Specific preparation to be required will unquestionably be clearly stated as to mathematics and science. Mathematics will go farther than it now does and in all probability will offer the calculus for those planning to go on in mathematics, or in science, or in engineering. Similarly, students planning to go on in these fields may be required to offer both chemistry and physics, and it may be that both subjects will be somewhat more advanced than the present courses usually offered in these fields. We may expect to see more emphasis upon the study of foreign language. There is no reason why this study should begin in the ninth grade and end in the tenth grade as is all too common a pattern. Indeed, there is no reason why it cannot begin in the fourth grade and continue through the twelfth grade. In fact, if we expect our students to master foreign languages this seems to be the way to do it. It is not essential that all students be required to take foreign languages according to such a pattern, but it is easily predictable that a group of the strongest colleges in the country—and this will include many state universities—may emphasize that pattern. Furthermore, it is to be expected that there will be a reviving interest in the teaching of English with particular emphasis upon English composition. The agitation has been going on for some years, in fact for so long that people have tended to discount the possibility that colleges might be serious, but there are genuine signs now that at least some colleges are prepared to turn away students who are unable to write an effective English paragraph.

Our fifth problem will be that of doubling, perhaps tripling, our present facilities. Viewed purely as an educational problem, this is a major undertaking. Despite advances in the materials and technology of building and the evident ability of many architects to look at educational problems in a creative sense, it is probably true that eight out of ten of the buildings in America used for educational purposes are so obsolete as to be expensive in maintenance or in instructional efficiency, or both. The term, "obsolete," as used here has nothing to do with the chronological age of the building.

Sixth, and finally a problem of education is to figure out how it is to be

paid for. Public higher education has not until recently shown signs of becoming a major tax burden. Now it is obviously going to. As it approaches the limit of tax support for any given period, it must make up the difference by student charges which means tuition increases. Private education represents another and more serious problem since it has been supported largely out of the surplus generated by the economy. At the present time, this surplus is being eroded by many factors—by heavy taxes due to defense spending, by the highly effective demands of labor unions for annual wage increases, by diversion into capital expansion. With the present direction of the economy toward the elimination of this surplus to produce what might be called a "balanced economy," we may question whether private higher education will continue to be able to finance itself. If it is to do so, it must be on a reduced scale or it must raise its costs to extract from its students the new money it will require. Thus, both public and private education will inevitably be more costly. They will both, and we had better face this, cost about twice as much as they now cost in real dollars. It is hard to see how anyone who advocates doubling teachers' salaries, and we all do, can think otherwise.

Within these general problems of education lie the specific problems of college entrance having to do with the students themselves—preparation, selection, placement, and support. I now come to the role of the College Entrance Examination Board in all this.

With respect to preparation, I can be explicit that the College Board does not undertake to control preparation nor to establish curriculum, with one exception which I will discuss shortly. The subject matter examinations of the College Board are one-hour, objective tests conducted under highly secure conditions, and never released for publication. They are described in a booklet called "Achievement Tests," which is distributed free of cost to applicants who apply for the tests and to schools which regularly send candidates to the College Board's examinations. These one-hour achievement tests, which are given in the social studies, the sciences, mathematics, foreign languages, and English composition, are each made by a committee of examiners—three college and two secondary school individuals—who work in company with test construction specialists of the Educational Testing Service. The tests are based on the examiners' judgment as to what is being taught. They are made, pretested with care, given under secure conditions, and scored with maximum attention to accuracy. The tests themselves are kept in constant equation with preceding tests so that scores have the same meaning from year to year.

The scholastic aptitude test, which we consider to be a kind of generalized achievement test, rests in its verbal section very largely on reading comprehension. We are often amused by the amount of vocabulary drill that is given in schools in an apparent attempt to prepare for this exam-

ination. It is, of course, a vocabulary test in the sense that every test is, but in no other sense, and vocabulary drill is not the best form of preparation for it. Primarily, it tests speed and accuracy of reading and of comprehension and of ability to use what is read in response to questions. The mathematical section deals with mathematical concepts rather than undertaking to test a wide range of mathematical skills. The students are expected to display an understanding of concepts and of their application and simple operation. Like the verbal section, it is a test of basic skills.

The College Board has been asked by schools to consider the question of coaching for Board tests. This problem has been studied with all diligence partly because the College Board itself is satisfied that its tests are not susceptible to successful coaching, and partly because we are loath to see candidates spend money they could otherwise use for college expenses upon an enterprise which has practically no chance of affecting their chances of admission. So far the College Board has been successful in establishing by research the fact that there is very little possibility of improving test scores by coaching, and quite unsuccessful in convincing any students that this finding applies to them.

The one exception to the College Board's self-imposed rule with respect to the influencing of curriculums has to do with our Commission on Mathematics. This is an activity begun several years ago, growing out of the statement made to us by our examiners in mathematics that they could no longer devise a mathematics examination based on contemporary high school curriculum which was responsive to the requirements of college mathematics. That is to say they found a gap, and a widening gap, between high school mathematics and college mathematics. Their proposal was that the College Board should investigate secondary school mathematics in terms of the curriculum and should recommend changes to be made. What I am saying about this should be no news to any mathematics teacher. Representatives of all the national associations of teachers of mathematics have met regularly with the Commission and its activities have received wide publicity. So far the actual mathematics test given by the College Board continues along traditional lines, but it is our firm intention to begin movement in the not too distant future in the direction indicated by the College Board's Commission.

While speaking of attempts to influence the curriculum, I should also mention the operations of what has come to be known as the Zacharias Group at Massachusetts Institute of Technology, which is attempting, under a grant from the National Science Foundation, to perform the same service with respect to the physics curriculum that the College Board is attempting with respect to mathematics. It is significant that these efforts in important fields long pre-date the advent of Sputnik.

A similar project being conducted at Tufts University, and supported

by the Carnegie Corporation, has recently been begun in the field of chemistry.

I conclude from the evidence that efforts have been started in three fields to influence secondary school curriculum, that its immunity to outside influence, which it has enjoyed relatively since the '30's, is now about to be at least temporarily suspended. I am inclined to suggest, in fact, that the only way it can regain this immunity is to itself take the lead in curricular reform. There is, I fear, some significance in the fact that three main efforts in curricular reform—four, if the activities of the Modern Language Association are to be counted—have in the main been started outside the orbit of secondary school activities, and that although they have drawn many secondary school teachers and administrators into their development program, they have been wholly directed by individuals drawn from higher education.

Regarding selection of students for admission to college and use of College Board tests in the process, it should be clear to start with that while we believe the Board's tests to be the best that can be made, we do not claim that as tests they are different from other good tests. The difference lies in the fact that we make new forms every year and that they are pretested, standardized, secure, nationally administered. They come with a complete service and do not have to be supported by schools and colleges. This gives them a value for selection purposes that no other program offers.

With respect to placement of newly admitted students in college courses and course sections, it is necessary to point out that the College Board has two testing programs.

One program consists of its regular one-hour objective achievement tests already mentioned in connection with college preparation. These may be used to place students in English composition sections, mathematics sections, language sections, and sometimes in science classes. In general, their range does not go beyond the freshman year.

For students who have taken advanced work prior to college entrance, we offer advanced placement tests serving the Advanced Placement Program. This Program is now in its fourth year and will this year draw several thousand students from several hundred schools offering advanced placement courses. The students will go to at least two hundred colleges, most of which have undertaken to recognize satisfactory performance by giving either advanced placement, that is, placement in a more advanced course, or hours of college credit toward a degree, or both.

In order to foster the development of the Advanced Placement Program, we have run for each of the past three years a series of subject matter conferences on teaching of advanced placement courses. Between five hundred and one thousand school and college teachers have attended

these conferences each year. We expect very nearly one thousand teachers in our June series this year.

The final area of the College Board's activities to be covered is that of financial aid for college students. In response to a request from its collegiate members, the Board several years ago instituted the College Scholarship Service. This is a service which helps a candidate who feels a need for financial help to communicate both the fact and the degree of his need to as many colleges as he may choose. It begins with a form which resembles the familiar income tax blank, a form which quickly establishes the fact that families are expected to support their children in college in the light of their total means, and that in considering their total means due attention shall be paid to their total liabilities. Thus, the effort is to determine not only income, but capital assets, and not only current liabilities, such as installments on a car, but long-term liabilities, and continuing obligations such as other children in school, or family illness. From this information there can be drawn a figure indicative of the student's need, if any, for financial assistance. Colleges may calculate this figure themselves or ask the College Scholarship Service to do it.

Out of this activity has come a firm and usable basis for a number of scholarship programs. The National Merit Scholarship Program, the General Motors Program, the California State Program, all depend in some measure upon techniques and operations evolved by the College Scholarship Service.

There are many problems I have left untouched and many details unexplained. This has been deliberate. This report has not been an effort to sell a single pill of educational aspirin for the relief of all our miseries of college preparation and college admissions. Rather it has been an effort to state some problems and to outline some approaches to those problems that are now being tried. There are many other approaches. The College Board has no monopoly on skill or wisdom. There is no foolish optimism, but rather simple truth, when we say that we who are working today as educators have an opportunity and a challenge that is unique in our history as a nation. The important thing is to work on our problems, not to waste our time in heaping recrimination upon educators of an earlier generation, or for that matter upon schools or colleges today. The work we accomplish, the decisions we make, will have an influence far beyond our time.

WHAT CALIFORNIA HIGH SCHOOLS ARE DOING ABOUT JUVENILE DELINQUENCY

BY ROBERT D. MORGANS*

We have all probably heard the statement, "Let the parents and community take the responsibility for solving this juvenile delinquency problem. We schools have enough of our own without taking on another one for which we are not primarily responsible." That the high schools of California have not heeded this "warning" and are, in fact, not only doing something about juvenile delinquency but in many cases taking a role of leadership is borne out in a recent informal survey.

This survey was made to gather material for a presentation to a discussion group at the 1956 Annual Conference of the California Association of Secondary School Administrators. It consisted of writing a personal letter to the principals of fifty representative high schools asking if they would jot down what they felt their high school was doing about juvenile delinquency. The almost 100 per cent response was both amazing and rewarding. In most cases the thoughtful and time-consuming two- and three-page letters were accompanied by programs, handbooks, outlines and other evidences of attack upon the problem. While the conclusions and examples presented may not have the validity of a carefully constructed and sampled survey, they illustrate what a number of schools are doing as their part in curbing this much publicized problem.

The main conclusion to be drawn from these replies is that high schools are attacking the primary causes of juvenile delinquency rather than merely patching up and "plugging holes in the dike" that is holding back the spread of juvenile delinquency. These causes stem from the basic assumption that a delinquent youth is an angry youth, angry at life and society. The main causes of this anger seem to fall into four classifications:

* Principal, Mt. Whitney High School, Visalia, California.

lack of success, no strong and accepting adult to turn to in time of trouble, a lack of genuine satisfaction that comes from engaging in activities worthwhile to self and society and in which a personal contribution is involved, and lack of a set of standards acceptable to self and society. The attempt here will be to classify and make general conclusions regarding what schools are doing to attack these primary causes and then briefly to mention some specific "ideas" being carried out in certain schools.

LACK OF SUCCESS

General Conclusions: Schools are attacking this cause by seeking ways of providing opportunities for successful experiences for all youth. These ways include continued curriculum revision, work-experience programs, grouping and special classes for both lower and brighter students, the developing of a faculty attitude on the importance of success to students (not a no-failure policy, but a policy of intelligent understanding of the place of success and failure), letting students know of their successes and the faculty's pride in them, letting the public know of student successes, a good continuation education program to keep 16 to 18-year-olds in school, and employment and placement services.

Ideas: Ewing Konold, then of Santa Monica High School, reported, "Actually we are more pleased over the accomplishments of our students than we are concerned over their failures. We try to have them understand our pride, and we use every legitimate manner to convey this to them and to compliment them for their achievements. It has been my experience that a teen-ager will do everything in his power to prove that what you say of him is correct. If you say he is a "bum" he will work over-time to prove you to be right. If you tell him he is a fine fellow and just has growing pains he will try to correct his actions."

The Student Council at Fullerton High organized a Student Public Relations Committee to write articles for the local paper and "letters to the editor" explaining conduct and activities of teen-agers to counterbalance impressions created by unfavorable publicity by the minor percentage of youngsters labeled juvenile delinquents.

Whittier High has established "project classes." These classes are in addition to point one classes and ". . . bank together those pupils who for several reasons are not making adjustments due to ability and skill or who because of unusual background situations find it difficult to face the rigors of competition in regular routine assignments."

NO STRONG AND ACCEPTING ADULT TO TURN TO IN TIME OF TROUBLE

General Conclusions: To counteract this cause, schools seem to be taking a dual approach, through providing for effective counseling in

school, and in working with parents to help them attain more influence as adult confidants. The need for better counseling is being met by more emphasis on attendance counseling and follow up, youth-guidance clinics available to all, youth-problem "councils" where representatives of various agencies meet to discuss and find ways of helping individual youths in trouble, more use of case conferences, striving to have each teacher feel and be a part of the counseling program, and group and individual guidance with emotionally disturbed youth.

Working with parents takes the form of individual conferences, particularly with pre-delinquents, parent education, both group and individual, and the helping of parents to set and enforce standards of conduct for young people.

Ideas: Madera Union High School has just recently set up a very well-staffed counseling program where each student is personally contacted a minimum of four to five times a year. That this helps is borne out by the statement of L. C. Thompson, District Superintendent, "While this method of individual counseling is fundamentally a trite deterrent to delinquency problems, still we are quite convinced here that there is a definite connection and a favourable one. . . . The report of our own Sheriff in Madera County, just put out this week, shows a very decided decrease in the number or delinquency cases during the past year."

Sturges Junior High of San Bernardino is in the second year of working with a small group of emotionally disturbed boys. "This group meets weekly in a semi-permissive and non-directive atmosphere. Each boy is thus permitted a greater release of hostility than is ordinarily possible."

In speaking of the use of case conferences, Alfred C. Siegler, principal of Hogan Junior High in Vallejo says, "To some people, I suppose, ten people giving their time and professional services for one student may seem like a waste of manpower, but they point up the fact that there is no easy or cheap way of really effectively attacking this problem of juvenile delinquency."

East Bakersfield High School has worked in close conjunction with the PTA in developing student and parent-prepared material on standards of social conduct. This is being used in informal discussion groups of ten to twelve parents held in their homes.

Campbell Union High feels that the spending of money to secure outstanding speakers for parent-education forums has been helpful.

Beverly Hills High sponsors an annual Home-School Conference for parents. The 1950 Conference developed a set of parental-student standards of conduct which is included in the Student Handbook under the heading, "Home responsibilities, family relationships and social life and customs of the high school student." This has been found helpful to parents in combating the familiar "all the other kids are doing it" retort.

Bullard High School also has a parent-student-made code of conduct published in an attractive and usable Parents' Handbook.

LACK OF GENUINE SATISFACTION THAT COMES FROM ENGAGING IN ACTIVITIES WORTHWHILE TO SELF AND SOCIETY AND IN WHICH A PERSONAL CONTRIBUTION IS INVOLVED

General Conclusions: This need is being met by providing a wide variety of activities in school as well as working with the community to increase the scope of this program. The most important conclusion is that the emphasis on these activities seems to be switching from large numbers and entertainment to welfare, doing things for others and for the community. This is exemplified in "welfare drives," activities that build a pride in the school and community, strong club programs with some clubs available to all students, student government in which every student participates and is aware of his participation, student committees to attack "problems" with some "problem kids" on the committee, and more widespread interscholastic athletic programs with more emphasis on a chance for every boy to participate. The community activity program is centered in strong support of city recreation and in some cases school-operated community recreation. There seems also to be a trend toward more cooperation through community youth councils to avoid duplication and increase effectiveness.

Ideas: Bakersfield High School has two Inter-racial Councils, boys' and girls'. "Here there is a free discussion of things that 'hurt' by a group elected to membership in proportion to the racial distribution of the student body. Under good leadership, and with membership being a distinct honor, this group anticipates trouble spots and does much to ease or eliminate them."

San Leandro High runs a strong club program that has been reasonably successful in getting pre-delinquent students into organized activities.

Fullerton Union High organized a Student Safety Council to deal particularly with the problem of improper use of automobiles. The committee included some of the fellows who were themselves offenders. Floyd Moore, Director of Student Activities, reports considerable progress as a result of this innovation.

Fullerton further reports recreational play-nights in the gym following night athletic events ". . . to keep as many students as possible off the streets after games." Dancing, Ping-pong, volleyball, basketball, swimming, badminton are featured. The last play-night had 700 students in attendance.

Hogan Junior High in Vallejo reports a PTA-sponsored, parent-supervised, series of Friday night dances open to all secondary school students

of the community. Participation has been outstanding with parents and the school enthusiastic over the results.

LACK OF A SET OF STANDARDS ACCEPTABLE TO SELF AND SOCIETY

General Conclusions: The main emphasis here seems to be one of helping the students themselves evolve and adopt acceptable standards. This is being done directly through classroom discussion and through codes of conduct developed by students and in some cases enforced by students. Students are also helped indirectly in this by character training through clubs, athletics, and character education propaganda to students by students through slogans, campaigns.

However, the continued need for adult guidance and direction in this setting of standards seems to be gaining renewed emphasis. This is evidenced by schools emphasizing the need for clearly defined and consistent rules of school conduct established by students, faculty, and administration. Also, parents are being brought together and as a group are setting and enforcing standards of social conduct.

Ideas: Manual Arts High School in Los Angeles has extensively developed student participation in formulating and enforcing standards of conduct. Entering tenth-graders are indoctrinated in the standards and traditions of the school in classes taught by twelfth-graders. These "student teachers" are called Guardians and prepare themselves thoroughly to take over this assignment. Further, the student court continues its long history of success in spite of a general tendency in recent years for other schools to drop this type of agency.

The students at Strathmore Union High School formulated and published their handbook "Codes of Conduct" under the headings of athletic, sportsmanship, assembly, and social. Gordon Axford, principal, reports considerable value in this project even before the enforcement phase.

It should be evident from this survey that California high schools are definitely active in the State-wide effort to curb juvenile delinquency. It is hoped that some of the ideas presented here may offer help to other schools. It is regretted that the remark of all principals who wrote could not be reproduced. Here in conclusion are two, that deserve quotation. H. E. Newbold, principal and district superintendent of Gustine Union High School says, "One of the best methods I know of to prevent juvenile delinquency is to keep school and community small. We are fortunate in both these respects." And John Pittman, principal of Turlock High School remarks, "I suggest to you that when adults act like children they are silly. When children act like adults they are often considered delinquent."

WHAT DO THE EXPERTS SAY ABOUT SUBJECT A AND ENGLISH PROFICIENCY?

BY GARLYN A. BASHAM*

A recent proposal from the College of Letters and Science of the Berkeley campus of the University of California to require passing the Subject A Examination as a basis for either freshman or advanced standing has focused much professional attention on this instrument.

What do educators think about the Subject A and high school English skills in general?

In an effort to obtain a cross section of such opinion, questionnaires were sent to the English Department chairmen of eleven institutions of higher learning in California. Replies were received from nine, which included five from State colleges and four from universities.

These are the statements in answer to the question, "What are the skills which a high school 'College prep' student should have acquired at the point of graduation?"

A. He should be able to read material of the level printed in *The Atlantic Monthly* or *Harper's* Magazine. This involves not only understanding the general idea but understanding the relations between the parts of the essay and the total idea.

B. He should be able to write organized and accurate essays in which he communicates his ideas about the world around him. This requires a capacity to construct logical sequences of thought and sufficient mastery of grammar, spelling, punctuation, and rhetoric so that the thought comes through to his reader.

C. Orally he should be able to do what he does in written form. He

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should learn to talk in complete sentences and paragraphs, and he should be able to listen well enough so that he can follow lectures and take notes on what is being said.

D. He should have an interest in, curiosity about, and love for books. They should be a normal part of his daily out-of-school experience. He should be able to put thoughts together coherently and to communicate them in a clear and interesting manner.

E. He should be in command of some of the basic skills of language. He should have developed a sentence sense so as to avoid "fragments" or "run-together" sentences. He should be able to spell the words commonly used in his written vocabulary, and he should have developed the habit of using the dictionary, and the library. He should know the basic principles of punctuation and be able to apply them correctly. He should know and apply simple principles of English usage: agreement, pronoun reference, verb forms, etc., and be able to speak without glaring illiteracies. He should be able to read with understanding at a level somewhat beyond the comic books and to write a short expository essay composed of well-developed paragraphs unified around a central idea.

F. He should be able to write naturally and fluently without making gross errors. He should be taught to draw upon his own intellectual resources so that he can bring to bear his total knowledge upon an essay topic. The kind of writing which should receive greatest emphasis is that which requires the student to deal as objectively as possible, with data and ideas which are not uniquely personal. . . . Students should express themselves but be able to discipline their expression. The research paper is generally inappropriate in the secondary school. . . . Courses in "creative writing" should be elective and should be limited to students of superior gifts, and even for these students disciplined habits of expression should be stressed.

G. Students should be able to express themselves with facility and clarity and without embarrassment. *Clear thinking* precedes clear expression *in speech* as well as in writing. They should be taught accurate listening and the ability to criticize what they hear.

H. He should have the ability to speak and write the dialect of American English that is used in the direction of business and other public affairs, including the ability to spell and punctuate it conventionally. But more important, that ability should have become a habit before he enters college.

I. He should be able to write competent essays, which, in addition

to correct spelling, punctuation, grammar, and paragraphing, show coherence and organization.

J. Students should have acquired a thorough knowledge of the fundamentals in sentence, paragraph, and composition structures, and in acceptable usage. Specifically, the students should be able to recognize and identify such principles as unity, coherence, emphasis, transition, subordination, coordination, and parallelism. He should know how to punctuate after a sentence, how to separate main clauses, and how to set off parenthetic elements. He should know the common uses of capitals and of the apostrophe, and should have mastered the so-called "spelling demons."

K. He should have acquired at least the ability to read accurately standard English authors of reasonable difficulty, to organize his thoughts and write them down with some grace and good mechanical accuracy, and to understand clearly the mechanics and techniques of such matters as punctuation, sentence structure, paragraphing, and discrimination between related words.

It is apparent from the above that there exists a rather general agreement of desirable standards to be attained by high school graduates who intend to continue their education at a senior institution.

How do these same English Department chairmen feel about Subject A? There is a divergence of opinion. The replies to the question, "Is the Subject A Examination a suitable goal for all high school students?" were revealing in this respect.

A. This test is given at the University of California, and I don't know what it tests. A student who does well on our entrance test does well in all of his college subjects in about 90 per cent of the cases studied.

B. The subject A is purely a device to separate the sheep from the goats. I would not regard any such placement test as a worthy goal for a student planning to enter college.

C. I believe that this examination is much over-emphasized in high schools as well as much misunderstood, and I deplore the practice of coaching students to pass it instead of teaching them principles which should enable them to pass this or any similar examination.

D. Subject A does not represent a goal but a minimum of achievement. What Subject A demands is that students be able to express themselves clearly with a minimum of gross blunders. Unquestionably, the matter that is tested by this examination is appropriate matter

to occupy the energies of all high school students, including certainly those who are never going to college.

E. Though the Subject A is not a suitable goal for all high-school students, all graduates should have had continuous, cumulative training in the structure of the sentence, in the nature of language, and in the concept of meaning.

F. The scope of the Subject A examination seems to be widely misunderstood. It is designed to test only such minimal skills as organization of ideas, punctuation, vocabulary, sentence structure, paragraphing, ability to understand accurately what one has read, etc., and in fact imposes very modest standards for college admission. The grading of the essay in the second part of the examination is carried on with an eye to mechanical accuracy and a reasonable amount of elementary organization.

G. Many high school teachers place altogether too much stress upon the Subject A. . . . In many communities throughout California . . . pressure is exerted upon teachers of senior English to convert their courses into a cram course that will prepare students for one goal only—to pass Subject A Examination. This kind of pressure is most unfortunate.

Space will not permit a summary of the entire questionnaire, but the following suggestions will serve to point up the general agreement pertaining to desirable proficiency in English. The question asked was, "In your opinion what more than is now being done should be attempted by English departments in high schools?" "Should there be more emphasis on remedial reading?"

A. There should be more writing experience for college preparatory students. Also closer reading of texts is recommended. Habits of accurate reporting should be encouraged; there is too much superficiality and approximate statement. Students should be helped to have opinions which they can support by definite ideas and by reference to sources. Interest in books should be stimulated. Much emphasis should be placed on remedial reading, preferably before students get into high school but there also if needed. I favor grouping students in English according to their abilities and then giving them all they can take.

B. Not more kinds of things but perhaps fewer. There should be a steady emphasis on the reading of good books, on writing and the several skills basic to writing, and on speaking . . . Attention to the kinds of matters—the skills of reading and writing—that are

tested on the Subject A Examination should not be left until a senior "cram" course. They should always be the business of the English program at every level.

C. There should be more emphasis on reading before it gets to the remedial stage. At present, no doubt, there is need for great emphasis on remedial reading in high schools. But the basic problem will never be solved merely by opening more remedial reading classes and putting more students into them. The problem will be solved, if ever, by thorough investigation of the reading program of the schools from the beginning upward. . . .

D. Research conducted here shows that training in remedial reading produces important results only when the student's ability to read tests lower than his general intelligence. Where the two tests correspond closely, the training produces results which are incommensurate with the cost.

E. A balance should be reached between a knowledge of terminology and an understanding of principles and their application. Training in the writing of letters, both business and personal, exposition—clearly organized, interesting, and written with a proper regard for the conventions of correct usage—seems to me to be significant in high school English.

F. Judging from the students who come to our institution, I should recommend more emphasis upon remedial reading . . . To a large extent achievement is based upon ability to read.

G. I agree that students should get all possible help in becoming more intelligent readers.

The above listed standards and proficiencies for high school graduates have very definite implications for junior colleges just as does the University of California proposal regarding the Subject A Examination.

While there would probably be little disagreement with respect to minimum standards, there are a variety of opinions as to how the desirable proficiencies can best be measured.

INDUSTRIAL ARTS EDUCATION IN FOUR-YEAR AND SENIOR HIGH SCHOOLS

BY ROBERT L. WOODWARD*

In designing industrial arts programs to meet the different interests and aptitudes of students in four-year and senior high schools, California school administrators must take into consideration a variety of factors.

One factor that merits attention is that an increasing number of students entering high schools have had introductory industrial arts experiences in separate shop facilities in either seventh and eighth grade programs in elementary schools or seventh, eighth, and ninth grade programs in junior high schools. In planning high school industrial arts programs, administrators should give consideration to the skills developed and instruction obtained by students in previous industrial arts courses.

Ways of enriching and extending other subject fields are also factors which should be considered in planning the industrial arts program. The experiences selected for these purposes should provide students opportunity to (1) make practical use of their knowledge of skills relating to tools, materials, and processes in designing objects; (2) apply safety practices which have application in school, home, community, and industry; (3) develop understanding of oral and written communication as a result of following instructions for shop activities; (4) make computations required in planning and completing jobs; (5) become familiar with the scientific principles involved in the operation of equipment and in the construction of objects; (6) develop effective working relationships and practice democratic procedures through participation in shop manage-

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ment; and (7) obtain information concerning requirements of industrial occupations and discover vocational interests.

Planning an Industrial Arts Program

In planning an industrial arts program for a particular school, consideration should be given to the potential enrollment of the school. The number and types of shops selected should provide for present needs and future expansion. Attention should be given to the total anticipated enrollment in the shop program, the enrollment in each phase of the program, and to the needs and abilities of the students who will be enrolled.

Basically, an industrial arts program should offer students opportunity for experiences in drafting, electricity-radio (electronics), metalworking, and woodworking. Activities in these areas may take place in a single shop or may be divided among a number of shops.

A plan for the organization of industrial arts programs according to grade level and school enrollment with recommended number and types of shops and the instruction follows. This plan is arranged in three columns and each column has an appropriate heading.

The enrollment figures used in column one and the number of shops recommended in column two are based on State-wide average enrollments in industrial arts courses and departments in the public schools of California derived from the reports of secondary school principals, October 1953. The types of shops and the instruction that may be provided in these facilities are consistent with the findings of surveys of present practices and with standards appearing in these California State Department of Education publications: *Suggested Courses of Instruction in Industrial Arts for the Junior High School Level*, *Suggested Courses of Instruction in Industrial Arts for the Senior High School Level*, and *Guide for Planning and Equipping Industrial Arts Shops in California Schools.*

The number and types of shops listed in column two take into consideration the long-term purpose of each shop and the limitations caused by multiple use of a shop. In the third column "Areas of Instruction," courses and elements of courses (activities) are presented that may be offered in the facilities proposed in column two.

RECOMMENDED NUMBER AND TYPES OF INDUSTRIAL ARTS SHOPS AND INSTRUCTION THAT MAY BE PROVIDED FOR FOUR-YEAR AND SENIOR HIGH SCHOOLS ACCORDING TO SCHOOL ENROLLMENT

Total School Enrollment	*Number and Types of Shops*	*Areas of Instruction*
to 250	ONE SHOP 1—Comprehensive General	Activities or courses: Drafting, electricity-radio (electronics), general metal, and general wood.

Total School Enrollment	*Number and Types of Shops*	*Areas of Instruction*
250–500	TWO SHOPS 1–Metal 2–Wood	Courses: Drafting, general metal, and general wood. (Note: Drafting courses would be provided in a shop classroom, a multipurpose classroom, or the wood shop. Activities or courses in electricity-radio (electronics) may be provided in the metal shop.)
500–750	THREE SHOPS 1–Metal 2–Wood 3–Auto	Courses: Auto mechanics, drafting, general metal, and general wood. (Note: Drafting courses would be provided in a shop classroom, a multipurpose classroom, or the wood shop. Activities or courses in electricity-radio (electronics) may be provided in the metal shop.)
750–1,000	FOUR SHOPS 1–Metal 2–Wood 3–Auto 4–Drafting	Courses: Auto mechanics, drafting, general metal, and general wood. (Note: Activities or courses in electricity-radio (electronics) may be provided in the metal shop. Activities or courses in graphic arts may be provided in drafting room.)
1,000–1,250	FIVE SHOPS 1–Metal 2–Wood 3–Auto 4–Drafting 5–Electricity-radio	Courses: Auto mechanics, drafting, electricity-radio (electronics), general metal, and general wood. (Note: Activities or courses in graphic arts may be provided in drafting room.)
1,250–1,500	SIX SHOPS 1–Metal 2–Wood 3–Auto 4–Drafting 5–Electricity-radio 6–Graphic arts	Courses: Auto mechanics, drafting, electricity-radio (electronics), graphic arts, general metal, and general wood. (Note: Activities or courses in photography may be provided in the graphic arts shop.)
1,500–1,750	SEVEN SHOPS 1–Metal 2–Wood 3–Auto 4–Drafting 5–Electricity-radio 6–Graphic arts 7–Handicraft	Courses: Auto mechanics, drafting, electricity-radio (electronics), graphic arts, handicrafts, general metal, and general wood. (Note: Activities or courses in photography may be provided in the graphic arts shop.)

1,750–2,000	EIGHT SHOPS 1–Metal 2–Wood 3–Auto 4–Drafting 5–Electricity-radio 6–Graphic arts 7–Handicraft 8–Photography (or a duplication of one of the other shops.)	Courses: Auto mechanics, drafting, electricity-radio (electronics), graphic arts, handicrafts, general metal, photography, and general wood. (Note: If photography is provided for elsewhere in the curriculum, additional courses may be provided in any of the above areas.)

If the enrollment for a school exceeds the largest total enrollment appearing in column one of the preceding organizational plan a duplication of shops could be made according to student demand. Basic and advanced shops could be provided in areas of industrial arts where the need exists.

More detailed information, which appears in California State Department of Education publications, may be helpful in deciding on the areas of industrial arts to be offered, types of activities that may be conducted, layout of shops, and kinds and quantities of equipment. Three of these publications are *Guide for Industrial Arts Education, Suggested Courses of Instruction in Industrial Arts for the Senior High School Level,* and *Guide for Planning and Equipping Industrial Arts Shops in California Schools.*

Designing an industrial arts program to meet the different interests and aptitudes of students, giving consideration to previous shop experiences that may have been provided for the students, determining the relationship of industrial arts courses to the other subject fields, and providing an adequate number of areas of industrial arts will assist in the development of a program for the high school that is educationally sound.

CURRENT EVENTS AND MATERIALS IN THE JUNIOR COLLEGE FIELD

BY ROBERT E. SWENSON*

Staff Named for New Bureau of Junior College Education

Hugh Price, former Director of Ventura College, has assumed the position of Chief of the Bureau of Junior College Education in the State Department. Robert Stone will assist as Consultant in the Bureau.

New Junior College Districts

Most recently formed districts among California's junior colleges are the Palm Springs–Coachella Valley District, and the Foothill College District serving the Palo Alto, Los Altos, Sunnyvale, Mountain View, and Cupertino area.

New College Campuses

American River (North Sacramento), Chaffey (Ontario), and Sierra (formerly Placer Junior College) have recently selected sites and are in various stages of planning or construction.

Appointments

Cerritos College: Floyd Younger, immediate past president of the Southern California Junior College Association and long-time science instructor at Fullerton Junior College, has moved to Cerritos as Dean of Instruction and Extended Day.

Chaffey College: Rex Wignall succeeded Leo Wadsworth who recently retired as Director.

* Dean, Liberal Arts Division, Long Beach (California) City College and Consultant Editor for the *Journal*.

Coachella Valley Junior College: First employee of this new district is Gail Brumwell who will serve as business adviser to the Board.

El Camino College: Forrest Murdock has retired as Superintendent and has been replaced by Stuart A. Marsee, formerly Assistant Superintendent of the Pasadena City Schools.

Foothill College: Calvin Flint, first President of the new Peninsula college, has announced the appointment of Hubert Semans, formerly with the State Department of Education, as Dean of Instruction and Arla DeHart, formerly of Monterey, as Dean of Students.

Contra Costa College: As of July 1, George Faul became its new Director.

Long Beach City College: Russell R. Johnston, Dean of the Liberal Arts Division, retired this year and was succeeded by Robert Swenson. Swenson is currently President of the Southern California Junior College Association.

Los Angeles Harbor Junior College: Named during the summer to succeed Raymond Casey, retired, was Dr. Wendell Black who had been Dean of Special Services at Los Angeles City College.

Los Angeles City System: Dr. William McNelis has been appointed Administrative Coordinator for junior colleges. McNelis previously served as Dean of Instruction at Los Angeles Valley College.

Monterey Peninsula: Dr. Fred Huber, most recently at Palo Verde, succeeded Calvin Flint as President, when Flint moved to the new Foothill College.

Palo Verde Junior College: Dr. Robert M. Baker assumed the position of Director when Fred Huber moved to Monterey.

San Bernardino Valley College: Dr. Herman Sheffield, formerly Director of Admissions and Registration at USC, was named the new President when John Lounsbury retired.

San Mateo College: Harold Taggart, retiring as Dean of Instruction, has been replaced by Phil Garlington from Stockton College.

Santa Barbara Junior College: Leonard Bowman, Director, has moved into the central office of the Santa Barbara District. Joe Cosand, former Director of Contra Costa College (West), was appointed President.

Program Innovations

A number of junior colleges including Glendale, Sacramento, Stockton, and Long Beach are offering college credit courses for selected high school seniors.

Contra Costa College has inaugurated a new program of training for supervisory personnel in the construction industry.

Junior colleges are assuming new responsibilities in nursing education. Two-year programs leading to the Associate in Arts degree and certifica-

tion for the Registered Nurse examination are now being offered at twelve colleges, with several others planning to admit students in September 1959. It now appears that the Kellogg Foundation will support a five-year study of the new two-year professional nursing curriculums in California.

Accreditation

California junior colleges have just completed the first five-year cycle of accreditation visits. Accreditation is accomplished through the Western College Association. General supervision is provided by the Commission for Accrediting Junior Colleges, whose members are two representatives from the Western Colleges Association, one from the State Department of Education, and three from the California Junior College Association.

Health, Physical Education, and Recreation Study

A comprehensive study of health instruction, health services, physical education, and recreation programs in California junior colleges has recently been completed. Louis E. Means of the State Department of Education staff directed this project.

Moral and Spiritual Values Conference

This conference was held on the Davis campus of the University of California in January of 1958. Nearly two hundred persons from fifty-six California junior colleges spent three days in serious planning to insure that greater emphasis would be given to these important values as junior colleges serve increasing numbers of students.

Publications

"California Public Junior Colleges" is the title of the newly published State Department of Education bulletin prepared by JC Bureau Chief, Hugh Price. This booklet should be invaluable for in-service programs with junior college faculty members as well as for broadening the acquaintance of the general public with the numerous purposes of junior colleges and the variety of community services that they provide.

Moves Toward New Junior College Districts

The State Department of Education recently completed a survey of the Whittier, Alhambra, El Monte, and Montebello Districts with a view to the formation of a new junior college.

Continuing interest is being shown in the possibility of forming a junior college district covering all of San Luis Obispo County. Similar study is underway in Santa Cruz County.

Junior College Internship Teacher Education Program

Dr. James C. Stone, Director of Teacher Education, University of California, Berkeley, announced recently that under a grant of $85,000 from the Ford Foundation, a program will start next summer designed to augment the supply of junior college instructors. Candidates must have an M.A. in a subject field appropriate for junior college teaching, have proper personal and scholastic qualifications for University graduate study, give evidence of personal fitness for teaching, have a contract for employment as a full-time teacher in a cooperating junior college, and not have had previous courses in Education.

Enrollments

Enrollment summaries for 1957–58 reveal that junior colleges enrolled 60 per cent of all full-time freshman and sophomore students in California collegiate institutions. If both full-time and part-time students are included, two-thirds of the State's entire total of freshman and sophomore college students were in junior colleges (this does not include classes for adults).

1960 WHITE HOUSE CONFERENCE ON CHILDREN AND YOUTH

President Eisenhower is the sixth President to call for a White House Conference on Children and Youth, a national meeting of leaders from many professions who are interested in the welfare of American young people. In May this year he asked that such a conference be held in March 1960 and that the Secretary of Health, Education, and Welfare take the lead in preparing it.

One of the Secretary's first actions was to send letters to all State governors inviting them to participate in the national rally. He requested each governor to appoint a liaison committee, broadly representative of all groups concerned with children and youth, to work with the national committee and to act as a communications channel between the State and the staff of the conference.

Choice of a theme for the 1960 meeting—one reflecting the needs of children and youth in these times—will be the task of the President's national advisory committee, which he plans to appoint this fall. Meanwhile, the Children's Bureau of the Department of Health, Education, and Welfare, in line with its assignment from the Department to put the conference in operation, is choosing a conference staff, to be attached to its office. Several professional groups have already met with officials of the Children's Bureau to discuss their particular interests in children and youth.

The story of the White House Conference on Children and Youth goes back to 1909 and President Theodore Roosevelt. The great conservationist President saw in youth America's first treasure, more precious by far than the land and game he loved. A White House Conference on Children and Youth has been held in every decade since, and the results—such as the closer cooperation of the many organizations devoted to child welfare—attest to his wisdom. The Children's Bureau was itself founded as a result of the first conference.

—School Life, September 1958

WHAT'S HAPPENING IN CALIFORNIA SECONDARY SCHOOLS

BY WILLIAM N. MCGOWAN*

Dr. Lowell McGinnis, Secondary Administrative Coordinator, *Los Angeles City Schools*, reports an interesting survey made of the 1958 Los Angeles Summer School Program. The purposes of the survey were to gather information about pupils and why they were attending summer school.

Enrollment

In the twenty-seven secondary summer schools, there was an individual enrollment of 39,767 as of the classification report on Friday of the first week of school. This was an increase of 41 per cent over the 1957 enrollment. Listed below are the schools and the classification report as of the first week:

Junior High		*Six Year*		*Senior High*	
Emerson	1,032	Banning	1,094	Belmont	1,036
Foshay	1,297	Eagle Rock	1,535	Hamilton	1,091
LeConte	926	Fremont	1,382	Hollywood	2,753
Mann	563	Gardena	761	Los Angeles	2,345
Sequoia	977	Huntington Park	1,917	Manual Arts	2,014
Stevenson	695	Jefferson	991	Reseda	1,610
Van Nuys	1,377	San Fernando	1,714	Aggeler	78
		San Pedro	1,079	Roosevelt	2,249
		Westchester	1,227	Metropolitan	176
		Wilson	931	University	1,564
				Van Nuys	3,171
				Washington	1,233

* Executive Secretary, California Association of Secondary School Administrators.

The Summer School Student Body

The average summer school student body is composed of approximately 41 per cent of pupils from the home school; 48 per cent of the pupils are from another Los Angeles City school, 8.9 per cent from private or parochial schools, and 1.7 per cent of the pupils are from schools outside the Los Angeles City School District but have established residence within the district. The high enrollment from private or parochial schools shows a working relationship between schools working within the Los Angeles School District.

Why Pupils Attend Summer School

One of the primary reasons of the survey was to determine just why pupils attend summer school. The following figures show the reason for their attendance:

	Junior High Per Cent	*Senior High Per Cent*
Making up a failure	19.1	13.5
Raising a mark (other than failure)	17.1	14.9
Acceleration	6.3	8.7
Enrichment	31.9	13.7
Making schedule easier next fall	7.5	26.4
Taking required courses	4.3	17.2
Strengthening weakness in subject matter	6.1	3.2
To be with a friend	1.4	.5
Nothing else to do	6.3	1.9

Note that there was a large percentage of pupils attending summer school at the junior high school level because of enrichment. Much of this enrichment work was done in the field of business education where typing is a much-desired subject. Many of the summer schools borrowed additional typewriters from neighboring schools so that they could offer this subject to many more pupils.

At the senior high school level, 26.4 per cent were attending summer school to make their schedule easier. As we realize, this does not mean they sought a "snap" course, but it would allow pupils enough time during the regular year for pupil leadership, drama, athletics, orchestra, or other interest fields. Some high school majors who take summer school courses have little opportunity to take a subject outside their major field

of study. Too, many high school pupils have part-time jobs during the school year and by going to summer school may ease the pressure on themselves in the following semester.

Of the summer school pupils, 1,022 became eligible for graduation at the end of summer school. Of this total, 348 were junior high school and 764 were senior high school pupils. This means that this many pupils moved ahead in their educational program instead of having to make up the requirements for graduation. When you add the number of those to be graduated to those who are accelerating and those who are making up failures, the summer school program is not only a real educational endeavor, but it is also a most economical program. The per capita cost for a high school pupil last year was $485.34. When you multiply this by the number of pupils who will progress one semester, it is apparent that summer school offers a real saving to the secondary school district.

Why Pupils Enroll in Mathematics Classes

This past summer at least 12,857 secondary pupils were enrolled in mathematics classes. Shown below are the numbers of boys and girls in junior and senior high schools and the reasons that they attended a mathematics class.

	Junior High			*Senior High*		
	Boys No.	*Girls No.*	*Per Cent*	*Boys No.*	*Girls No.*	*Per Cent*
Making up a failure	660	376	25.8	862	436	14.7
Raising a mark (other than failure)	738	603	33.4	1,935	1,302	36.6
Acceleration	96	79	4.4	303	240	6.2
Enrichment	331	119	11.2	301	224	5.9
Making schedule easier next fall	114	193	7.6	791	748	17.4
Taking required courses	71	55	3.1	520	477	11.3
Strengthening weakness in subject matter	193	215	10.1	251	213	5.3
To be with a friend	10	17	.1	25	17	.5
Nothing else to do	35	59	57	151	1.5	
Totals	2,310	1,710		5,096	3,735	

These figures reveal the large number of failures in mathematics during the regular school year. In addition there is a large percentage of pupils who are raising a mark. Over 50 per cent of junior and senior high school pupils enrolled in mathematics classes were there to make up failures or to raise a mark. This is especially noticeable in mathematics courses as

students are strongly recommended to strengthen their abilities in mathematics before proceeding to the next mathematics course. With the terrific competition for acceptance in college, more of our secondary pupils are giving unusual attention to their mathematical needs. Too, pupils and parents are impressed by the emphasis put on mathematics and science during the last few years, and so more attention is being focused upon these particular fields.

Why Pupils Enroll in English Classes

There is always a heavy demand in summer school for classes in English. This summer at least 9,704 were enrolled in this subject. Shown below are the reasons that pupils enrolled in English classes:

	Junior High			*Senior High*		
	Boys No.	*Girls* No.	*Per Cent*	*Boys* No.	*Girls* No.	*Per Cent*
Making up a failure	708	221	29.9	1,059	427	22.5
Raising a mark (other than failure)	506	225	23.5	271	145	6.3
Acceleration	165	143	9.9	310	290	9.1
Enrichment	263	233	15.9	199	250	6.8
Making schedule easier next fall.	90	100	6.1	1,159	1,294	37.2
Taking required courses	71	43	3.7	470	430	13.7
Strengthening weakness in subject matter	154	93	7.9	79	89	2.6
To be with a friend	14	8	.7	14	11	.4
Nothing else to do	44	30	2.4	56	40	1.4
Totals	2,015	1,096		3,617	2,976	

Here again one is impressed by the high percentage of pupils who are making up failures. There is also a large percentage of pupils (senior high, 37.2 per cent) taking courses so as to enjoy greater flexibility in their program next fall. Many of the high schools recommend an additional semester of English over the four semesters required, for those pupils in college preparatory courses.

Why Pupils Enrolled in Business Education

It is interesting to note below that in the field of business education, over 45 per cent of the pupils enrolled for enrichment. The great majority of these enrolled in typewriting. Pupils from the private and pa-

rochial schools are very interested in these classes, as they are not offered in many of their schools. Too, typing is a skill that many academic pupils desire as a means of preparing better papers in college. Parents, also, encourage the youngsters to take this practical course.

	Junior High No.	*Six Year No.*	*Senior High No.*	*Total No.*	*Per Cent*
Making up a failure	20	234	237	491	7.3
Raising a mark (other than failure)	45	128	227	400	5.9
Acceleration	39	212	214	465	6.9
Enrichment	1,029	830	1,239	3,098	45.9
Making schedule easier next fall	144	406	498	1,048	15.5
Taking required courses	8	184	483	676	10.0
Strengthening weakness in subject matter	32	69	123	224	3.3
To be with a friend	14	21	10	45	.7
Nothing else to do	112	108	86	306	4.5
Totals	1,443	2,193	3,117	6,753	

Why Pupils Enroll in Social Studies and Science

Listed below are the enrollments for social studies in junior high, six year, and senior high schools. We do not show boys and girls as we were mainly interested in the number and reasons for enrollment in this class. State requirements for social studies help to increase the enrollment in high schools.

SOCIAL STUDIES CLASSES

	Junior High No.	*Six Year No.*	*Senior High No.*	*Total No.*	*Per Cent*
Making up a failure	521	1,000	707	2,228	22.6
Raising a mark (other than failure)	252	247	212	711	7.2
Acceleration	111	445	484	1,040	10.6
Enrichment	154	180	153	487	4.9
Making schedule easier next fall	118	1,543	2,072	3,733	37.8
Taking required courses	76	459	838	1,373	13.9
Strengthening weakness in subject matter	43	34	30	107	1.1
To be with a friend	5	13	23	41	.4
Nothing else to do	35	59	57	151	1.5
Totals	1,315	3,980	4,576	9,871	

SCIENCE CLASSES

	Junior High No.	*Senior High* No.	*Six Year* No.	*Total* No.	*Per Cent*
Making up a failure	134	526	268	928	18.5
Raising a mark (other than failure)	72	544	98	714	14.2
Acceleration	62	283	127	472	9.4
Enrichment	101	402	146	649	12.9
Making schedule easier next fall	112	924	323	1,359	27.0
Taking required courses	57	477	162	696	13.8
Strengthening weakness in subject matter	10	41	18	69	1.4
To be with a friend	4	17	7	28	.6
Nothing else to do	19	60	31	110	2.2
Totals	571	3,274	1,180	5,025	

The pattern in science is quite similar to the patterns in other subjects.

Teaching Staff

In addition to the survey this year, a tabulation was made on the summer school teaching staff

Total number of applications 1,554

Status of teachers employed

- Permanent 748
- (Vice-principals selected as teachers ..... 15)
- (Counselors and registrars selected as teachers ..... 31)
- Probationary 221
- Substitutes 5
- Total number of classroom positions 974

Teachers in special programs

- Driver Training 56
- Agriculture 22
- Metropolitan High School 8
- Aggeler High School 5
- Total 91
- Grand Total 1,065

Number of years with the Los Angeles City Schools—Regular program

- 1 to 4 262
- 5 to 10 393
- 11 or more 319
- Number teaching for the first time 345
- Number teaching for 3d time in 5 years 247

Because of the increased enrollments, a large number of teacher applicants were employed. Although by the opening day of summer school 148 had made themselves unavailable, there was a surplus in the fields of English and social studies. There were not as many requests for junior as for senior high school teachers, which made for a surplus in this division. Fifteen vice-principals were employed in the summer schools. Vice-principals are limited to one session out of every three, and no more than one vice-principal may teach in any summer school having less than thirty teachers. The use of vice-principals in large summer schools has been very helpful in the administration of these schools, as in many cases they teach one period and help with pupil problems during the other period. This seems to be a good administrative practice.

Secondary Summer School Teacher Training

Superimposed on the secondary summer school, yet a vital segment of it, is the teacher training program. This year Los Angeles City schools were working with seven collegiate institutions using twenty-four of the twenty-seven summer schools. There are 213 regular teachers serving as training teachers for 244 student teachers. Although this is a service to the collegiate institutions, the Los Angeles School District will receive the benefits of this program as approximately three-fifths of all student teachers trained in the Los Angeles City schools eventually work in the local district.

Classes for the More Able Learner

Twelve classes for the more able learner were conducted as part of the summer school program. Specific evaluations of this program from the standpoint of pupils, parents, and teachers are being made.

IMPROVING THE TEACHING OF MATH

The National Science Foundation has granted $100,000 to Yale University to initiate a new program aimed at improving the teaching of mathematics in secondary schools. Edward G. Begle, associate professor of mathematics at Yale, will head a School Mathematics Study Group consisting of leading college mathematicians and secondary school teachers. The program will have two main objectives: to improve the training of math teachers and to work on revisions in the mathematics curriculum now used in secondary schools, including junior high schools.

—School and Society, Summer 1958

SYMPOSIUM

Toward Excellence in High School Science

Not since the days of Herbert Spencer's famous essay on *What Knowledge is of Most Worth?* has the subject of science as a subject in the school curriculum received so much attention. As with mathematics, which was considered last month in a *Journal* symposium, consensus exists both as to the basic importance of science in the curriculum and to the unsatisfactory manner in which it is now treated. The scientists themselves, at last, are turning attention to the kind of education in science that is needed in the elementary and the secondary schools. Furthermore, recognition is being accorded to the fact that science, once absent from the elementary school curriculum, is now being treated there, so much so that the whole sequence of science subjects in the high school needs alteration.

The size of the task of revising the science curriculum of the schools is so great that local communities or even states cannot alone accomplish what is required. The talent and interest of scientific scholars on a nationwide basis as well as large sums of money are needed. Fortunately, both are being supplied to support large-scale studies, the results of which are beginning to become available. However, it still remains for teachers, administrators, and citizens in local communities to take the necessary steps to improve the program in their own schools. This requires an understanding on the part of everyone, not just science teachers, of the many changes now underway and the new programs that are being recommended. To this end the symposium "Toward Excellence in High School Science" directs itself.

Special thanks for the coordination of the symposium goes to James T. Robinson, Coordinator of Science and Mathematics, Whittier Union High School District, who also contributed one of the articles, and to William S. Weichert, Supervisor of Science, Oakland Public Schools.

SCIENCE TEACHERS FOR THE NEW ERA IN SCIENCE

BY PAUL DeH. HURD*

The Problem

The importance of science in the education of young people has never been more clearly recognized than now. Contemporary society is charac-

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terized by the achievements of man in his pursuit of the knowledge of science and its applications in technology. A high school graduate without an understanding of the major concepts of science and the nature of the scientific enterprise must be regarded as culturally illiterate. Secondary education is at the place in history where it needs to be brought into balance with the forces which are shaping our society.

Problems of world industrialization and the emerging scientific revolution have introduced new issues into science education. In the "Rockefeller Report" on *The Pursuit of Excellence*, the situation is described as follows:

> The crisis in science education is not an invention of newspapers, or scientists, or the Pentagon. It is a real crisis.
>
> The cause of the crisis is our breath-taking movement into a new technological era.
>
> The immediate implications for education may be briefly stated. We need an ample supply of high calibre scientists, mathematicians, and engineers.[1] Quantitative arguments over the shortages in these fields are beside the point. We need *quality* and we need it in considerable quantity!

Those who have examined the secondary school science curriculum whether scientists, educators, or informed laymen have felt that major changes are needed. The demand is for a "modernization" of the content, a re-orientation of the objectives, and more effective instructional procedures. Curriculum changes greater than any proposed in the past fifty years are called for. "Breakthroughs" in teaching methods are sought through an examination of promising classroom practices and a re-examination of the research on learning.

The criticism recently directed toward the science teacher represents an awareness of his importance. It is one way of saying that he is crucial in the educational process and that America wants the best. Efforts to improve science teaching are wasted if they do not include a program to increase the number of qualified career science teachers.

Emerging Objectives for Science Teaching

The training of a science teacher must be related to the objectives he is expected to achieve. Some of the new directions in science teaching suggest the nature of these objectives.

Science should be taught as an intellectual achievement of man in his desire to understand the forces which control and give meaning to the physical and biological world. Academic achievement is to be found in the student's command of concepts and principles, not in the amassing of

[1] The report might also have added "science teachers."

isolated facts—facts represent only the skeleton of science. Theories and ideas are more crucial than techniques. Science and its creators should loom larger than technology and its inventors. The delineation of problems, the rationale of procedures, and the management of data are prized above answers. The experimental attack on problems is preferred over the descriptive.

Mostly what is desired in science teaching is depth and quality of understanding, to have the student sense what it really means to know something and to have confidence in his learning. This point of view is in contradiction to the cursory survey and taxonomic approach to science teaching so much in vogue. There is the problem of concentrating the content of science courses to replace the typical "watered-down" skimmings and smatterings, dribbles and dabbles of assorted facts and generalities that have reduced so many science courses to the point of intellectual neutralization. To develop an understanding of the scientific endeavor, and an appreciation of science as an intellectual achievement requires inspired teaching, by science teachers with unusual competencies.

The Science Teacher and Tomorrow's Curriculum

The career science teacher needed for the "new" school should have many of the characteristics of the applied scientist. He must have the training and interest to carry on a program of continuous research upon the teaching and learning problems of science instruction. He should be motivated and able to explore new ideas and theory under experimental conditions and to publish his results. His choice of a teaching career should also mean a desire for scholarship and professional leadership.

The science teacher should have a particular interest in curriculum development. He teaches a subject with an "endless frontier" and an expanding fund of knowledge. In addition, science concepts and principles are continually shifting in their importance as new theories establish new perspectives. This compounds the problem of developing a curriculum. It demands a continuous re-evaluation of courses and a recognition that the science curriculum is at the best a series of progressive changes. In developing a curriculum the science teacher must work closely with scientists and curriculum specialists. Of particular importance will be the association with scientists. They will always be in the best position to determine those aspects of research which have the widest ramifications and importance for understanding the nature of his field at the moment. Scientists have a professional responsibility to work cooperatively with science teachers in exploring specialized areas for possible contributions to the high school curriculum.

A curriculum appropriate to the objectives of science teaching is not generated automatically. It requires rigorous thinking in terms of an ac-

ceptable theory of education followed by classroom research. When the teacher is the researcher, as frequently he should be, he needs to be provided with consulting services, time, financial resources, and teaching assistants. When his summers are given to professional research the school district has an obligation to support the endeavor financially.

The Training of the Science Teacher

The training of the career science teacher should include an academic major with sufficient depth to permit continued study and a liberal education in related sciences and the humanities. Work in the related sciences should provide breadth to the special field and not simply a variety of courses. The liberal and special programs should parallel each other through undergraduate and graduate study. Education for the new era in secondary science teaching will require courses which consider the conditions which influence discovery in science, the nature of the creative process, and the tools of science. The science teacher needs more than a background in a specific field, because he needs to be trained in science as well as biology, chemistry, or physics. General education in the sciences should therefore include courses in the history and philosophy of science, science and human values, the literature of science, science and human progress, and the techniques of research.

Whatever the specialization of the science teacher a background in mathematics is essential. The laboratory experiment in high school science teaching is to provide students an opportunity to gain experience in scientific methodology which in turn requires a knowledge of how data are structured. Improvements in the quality of laboratory work will depend upon the training provided teachers in the mathematical aspects of experimental methods. The growth of the junior research programs, the science seminar, and advanced standing courses in high schools intensify the need for more mathematics in the training of science teachers.

The science teacher should have had some opportunity to participate in research activities at the undergraduate level. If he is to help students understand the procedures of theoretical inquiry he must himself directly have this experience in a research problem of his own, as an active partner in a larger university project, or as an intern in an industrial research laboratory. An understanding of the scientific enterprise is the most commonly accepted objective of science teaching, yet only infrequently do teacher training programs provide a background to help the teacher work toward this end.

The problem of training science teachers for secondary schools has yet to be faced by most colleges and universities. The assumption that the best education for a secondary school science teacher should be the same as that of a research scientist but to a smaller degree is untenable.

Science teachers need the competencies important to the interpreter of science and the researcher needs the training of those whose work is directed toward scientific discovery. These abilities are not the same. Although there are places where the preparation of each will overlap, the training needed to help high school students understand science and its procedures and to appreciate the work of scientists differs from that required to engage in research. The development of scientific literacy in the youth of America is the high school teacher's primary responsibility. To teach the first course in the professional training of a scientist is *not* his function. His training should be related to the functions he performs.

The professional training of the science teacher must acquaint him with the science curriculum from the elementary through the high school. The development of a twelve-year integrated science program means that teachers at every level build upon the previous attainments of students. Maximum results in science teaching require that the course work from grade to grade be sequential rather than repetitive.

In the future a science teacher will need special training in the management of science courses for the rapid learner and the science-prone student. The teacher who chooses to work with the gifted student must be able to devise courses suitable for the development of creative abilities.

The Work to be Done

A major function of the teacher in the new era of science teaching is to establish a "climate of learning" compatible with the course objectives. Many of his efforts will consist of developing in students a desire and the ability to assume an increasing responsibility for the direction of their own learning. Students will spend the year studying in depth a few major problems. Their learning activities will be like those of a research endeavor. The teacher devises ways to help young people organize their knowledge into concepts, to give it meaning through establishing relationships, and to stimulate ideas. This is the "quality" or "excellence" so widely sought in education today. To gain this end will require masterful teaching. And no longer can poor teaching be tolerated under the guise that science is more difficult to learn than other high school subjects.

There is no easy path to the development of an understanding of science. A wide range of suitable learning experiences offers the best chance. This requires equally varied teaching resources, such as class periods of sufficient length to perform worthwhile experiments, adequate equipment, a room library, a way to view films individually, a place for student seminars, and instructional materials in ample supply. It also means using the science resources of the community: scientists and engineers; research and industrial laboratories; farms and parks; swamps, rivers, lakes, and ocean; planetariums, arboretums, and observatories; deserts and meadows; rocks and mountains; stars and soils; and the many other sources

of data for interpreting the physical and biological environment. The student should take his science with him wherever he goes; time outside of school hours must also be a time to think about science, to observe, and to speculate. It is in this manner that science becomes meaningful.

The science teacher for the new curriculum must be resourceful and expert in devising laboratory work which gives students an opportunity to utilize the techniques and procedures of science. In these experiments the emphasis is placed on the management of the data, the limitations of the experimental procedures, and the use made of the results. Routine exercises of equipment manipulation, the blind recording of data, the demand for identical results from all students and the failure to make use of laboratory findings in the continuum of learning is to be discouraged.

The Supply of Science Teachers

The immediate supply of qualified science teachers is not large enough to meet the demands for the new curriculum. One state science committee has suggested that it might be better for a school to drop a science course than to continue it with an untrained teacher. The TV Continental Classroom offering a college-credit course in "Atomic Age Physics" for high school teachers is an attempt to increase the number of teachers in physics. Approximately three thousand secondary school teachers during this school year will be attending in-service institutes sponsored by the National Science Foundation. Thousands more will be found in year-long institutes and special summer programs. Hundreds of millions of dollars have been appropriated by Congress to increase the supply of science teachers, and to provide adequate facilities and equipment.

Some school administrators have developed ways to extend the services of their most effective career science teachers through the use of teacher aides, clerical help, and laboratory assistants to carry on routine duties. Scientists and engineers assist by assuming responsibilities for helping students outside school hours. Visiting consulting teams of scientists and curriculum specialists acquaint the teacher with the latest scientific and professional developments in his teaching field. The redeployment of teaching hours during the week has been used to place the expert teacher in contact with more students. An organized program of in-service education assists the qualified science teacher to extend his influence to other science teachers.

At no time in our history has a more concerted attempt been made to improve a curriculum area and to increase the number of adequately trained teachers.

NEW PHYSICS COURSE FOR HIGH SCHOOLS DEVELOPED BY THE PHYSICAL SCIENCE STUDY COMMITTEE

BY DARREL W. TOMER*

Editor's Note: *The most far-reaching development in the history of high school physical science is seen in the experimental physics course developed by a group of college and high school teachers known as the Physical Science Study Committee. Because this course represents a very decided innovation in physics as it is now taught and has been taught for decades past, the editors feel that the space allotted to high school physics should be devoted to a description of the "PSSC course," as it is usually called. Mr. Darrel W. Tomer, among the first to participate in developing and teaching the course, was asked to do this for us.*

Although there are other developments going on in the field of high school physics instruction, none can compare in sweeping changes and in probable effects to that described here. However, it might be well to point out that the filmed demonstrations by Professor Harvey White of the University of California, and the nationwide television course he is now conducting in college physics are bound to have an up-grading effect on high school physics.

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The new physics course developed by the Physical Science Study Committee is not part of the reaction to the launching of the Russian satellites. It is instead a considered answer to long-standing feelings of dissatisfaction with present methods of teaching physics in the high schools. It shows the aims and development of science for both future

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scientist and ordinary citizen. More important, it attempts to develop scientific physics from the ground up with nothing being handed down from high authority. It builds upon the student's intuition and adds to his experiences where necessary as he discovers how the laws of physics grow out of attempts to describe the observed phenomena of nature. He learns to try his own hand at formulating tentative descriptions and to re-examine them as new facts are discovered.

The easy reading nature of the opening chapters of Volume I of the text for the new course and the absence of formal definitions may suggest that the text treats physics in a superficial manner. A more careful examination reveals that basic physics concepts are being built upon a firm foundation which includes essential mathematical ideas. Volume I takes the student through the development of methods of measurement; the natural units of mass, space, and time found in the human body; through the development of standards and the extension of measurement into the mega- and micro- regions; on to the measurement of qualities completely foreign to the human senses. The student applies the mathematical concepts of scaling, orders of magnitude, vectors, and graphical representation to such topics as kinematics, atomicity, and molecules. By simple laboratory procedures the student determines for himself the sizes and numbers of atoms to order of magnitude accuracy.

Volume II concerns the origin, growth, and functions of scientific theory. Light and its many challenging effects are used as the tool for this development. A thorough grounding in wave phenomena results and is applied later in volume IV to the further study of light and wave mechanics. This knowledge of wave properties will also enable the student quickly to adapt himself to the study of other wave motions such as sound and radio, subjects not emphasized in the PSSC course.

Gravity, dynamics, energy, and momentum are introduced in Volume III. This discussion is aided by stroboscopic motion studies and the previously covered kinematics, which has now had a considerable soaking-in period. The growth of science is illustrated by Galileo's experiments and by a study of how the investigations by Kepler and Newton of our solar system contributed to the foundations of physics. Here, as all through the text, an attempt is made to introduce concepts in a manner calculated to eliminate painful re-examination before modern physics can be presented.

Volume IV, now in preparation, concerns electricity and modern physics. Topics include charges, fields, electromagnetism, energy levels, wave mechanics, and nuclear energy. Such technologies as AC circuits, radar, and TV are omitted.

In addition to the text, the PSSC course provides a laboratory manual of open-ended experiments generally requiring only very simple apparatus. A comprehensive teacher's manual is also being prepared to assist

teachers in overcoming the difficulties of adapting to the new course. Some sixty new movies are planned to provide help, especially in cases where demonstrations are beyond the scope of high school laboratories. The demonstrations will be presented by qualified scientists; no professional actors are to be used. For the student with an extra spark of interest there will be dozens of monographs to help extend his studies beyond the text.

At first glance this course seems to contain too much, but as teachers gain experience with the new materials, this will turn out to be more apparent than real. Also, further adjustments in the course are to be expected. There will be deletions, additions, condensations, rearrangements, etc., in the light of the experience of the teachers now using the course.

The course may also sound difficult in comparison with the usual high school physics course. One of the assumptions of PSSC is that the high school student is better prepared to accept a high level physics course than is generally thought, and that when the subject is presented so as to emphasize its natural development and its inter-connecting ideas, it is easier to understand. It must also be admitted that science and mathematics have seeped down into our culture at an ever increasing rate. Five years ago the teacher who wished to discuss satellites had first to define the term. Today "satellite" is a household word. The amazing achievements of science and technology have reached the home through newspapers, TV, new products, and toys. An increasing number of parents are employed in scientific, mathematical, and technological pursuits. Also, an increasing number of parents have taken science and mathematics in school.

PSSC physics is different not only for what it has added, but also for what it has left out. The reduced emphasis on technology does not imply disapproval, any more than the reduced dependence upon trigonometry implies disapproval of mathematics. The elimination of topics more properly classified as physics, e.g., simple machines and buoyancy, needs more justification. These were at the forefront of scientific investigation several centuries ago and do not now shed as much light on our present-day picture of the physical world as does a study of waves and particles. Further, their treatment is sufficiently simple to be readily self-taught by the physics student if and when he develops the need.

If the PSSC course exerts a lasting influence on the teaching of science in high schools, it will automatically create problems for both high schools and colleges. One immediate problem is the revamping of standardized tests. Educational Testing Service is developing new tests for use in high schools and for college entrance examinations. When the next crop of high school graduates applies for college admission, they will be allowed individual choice between a conventional physics test and one designed for PSSC students.

Why would a high school physics teacher choose to teach the PSSC Course? It is sufficiently different to demand that he acquire new knowledge, a new outlook, new texts, manuals, experiments, demonstrations, and apparatus. He may find it necessary to teach his favorite technology, radio for example, in another course. But, many teachers agree that the conventional physics course does not get at the spirit of science. They think that it kills interest with the presentation of scientific laws as dogmas to be verified in the laboratory. They would like to teach from a text that reads less like a dictionary and more like a continuing story of adventure and discovery. The experiences gained during the first PSSC courses and institutes indicate that most students find the new text enjoyable and stimulating. Furthermore, teachers find that they can acquire the new knowledge and outlook, and along with it a new enthusiasm for teaching their subject.

During the 1957–58 school year about a dozen high schools used the preliminary course. In most of these schools it was possible for the teachers to work closely with the committee and feed back their experience to the PSSC. This year, nearly three hundred teachers, most of whom attended five PSSC summer institutes, are teaching the course to about 12,500 students. Some in-service institutes are now offering teachers a chance to study the PSSC Course and an extended in-service and summer institute program is projected for 1959. From the reactions of these teachers and the successes of their students, the high schools of the nation will judge the PSSC program and consider the possibility of developing new patterns for other high school courses.

TEACHING HIGH SCHOOL CHEMISTRY

BY CLYDE PARRISH*

The purpose of this statement is to examine high school chemistry, what it presumes to be, and what it should accomplish as a part of the high school curriculum. It includes a consideration of the student, the subject, the teacher, and the demands of society, all of which require equal emphasis.

The Society

Ours is a scientific-technological society, increasing in complexity and interdependency, with no sign of losing its dynamic qualities. Chemistry is a part (a very large part) of it. Young people who must assume responsibility for this huge complex will require an education of very high professional-technical level. They will also need to understand science as one human endeavor, and technology as another, plus the blending of the two that has created the modern world. In addition, all citizens need to understand the nature of the society in which they live.

What departments or subjects in the high school are best suited to developing a student's understanding of the level of professional training that he must accomplish and to the understanding of society that he should also achieve if he is to consider himself to be truly educated? Most chemistry teachers accept without question their responsibility for providing instruction of a professional-technical nature. Many chemistry teachers, however, do not feel qualified to explain the part played by science and technology in the modern world. While their knowledge of chemistry as a single science may be extensive, their knowledge of the nature of all science as a whole may be quite limited as may be their ability to distinguish science from technology. Can they teach their students about the nature of science rather than simply leading them in the study of a

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single science, or must this be left to the social studies teacher? All science teachers should assume this responsibility. If they are unprepared, then they should undertake to prepare themselves.

The Student

Teachers of all subjects are prone to think of an ideal student rather than those who face them each day. The chemistry teacher needs to face one fact, the immaturity of most of his students, even the most able. Their skills are not fully developed; their ability to concentrate on a difficult subject is limited; their capacity to discipline themselves for hard study is not great; they are often unable to organize their thoughts for effective oral or written expression; they frequently cannot discriminate the important from the trivial as they listen and read; above all, they may be exceedingly naive in their ability to apply mathematics, either in computing or communicating. Chemistry, as a school subject, tends to expose these weaknesses in students.

Too often the chemistry teacher seems to confuse the issue in his own thinking; it is too easy to conclude that the student is incapable, now or ever, of mastering the subject of chemistry. This conclusion can be unfortunate. The teacher should direct his energies more toward counseling students concerning their weaknesses and helping them devise ways of improving their skills. In groups and individually, he can counsel students about their abilities and skills, and then teach in such manner that he tests, exercises, and strengthens the students' basic mastery of skills. Chemistry possesses the unique ability to exercise and test all skills. This is why it is regarded as a difficult school subject. Should it not also contribute to the *improvement* of skills? Since many students take chemistry in preparation for college it should help to prepare for college. If it does not it is simply a barrier and not really deserving of its label as a college preparatory subject.

The Subject

The subject of chemistry includes some of the best thinking achieved by the human mind. The prolific activity of the human mind is documented in the voluminous nature of chemistry. But this has posed two problems in the teaching of chemistry: limiting the amount to be taught, and selecting what is to be taught.

In the 1920's the Education Committee of the American Chemical Society undertook to identify the portion of chemical knowledge that should comprise high school chemistry.[1] This effort continued over a period of years. One notable aspect of the outline presented in their report was the extensiveness of the material to be covered.

According to Rosen[5] the past one hundred years of science teaching,

chemistry included, has seen a transition from the completely catechetical mode of teaching to the introduction of the lecture-demonstration and to the use of laboratory experiences. Today all three are in common use. Presumably the lecture-demonstration and laboratory experiences were introduced to broaden the student's experiences and provide him with an improved understanding. However, this intent seems to be thwarted, at least in part, by the huge amount of subject material specified as high school chemistry.

Certain ill-defined dissatisfactions have always existed in relation to high school chemistry. Some come from the effort to cover too much subject matter in too short a time. Some arise from the too great similarity between high school chemistry and college chemistry. The latter situation is compounded by the persistent practice of having the college freshman take first-year college chemistry with no regard for the quality of his performance in high school chemistry. This practice is ill-conceived for it undermines the confidence of the high school chemistry teacher, and encourages good students to acquire poor study habits. Fortunately, this practice is being modified by the Advanced Standing Program.[3] Indications are also that a major revision of both high school and college chemistry will be undertaken in the near future.[2,6]

The high school chemistry texts in common use reflect the swollen character of the subject matter of high school chemistry. Teachers often use the text as the basic outline for their course rather than developing their own outline. The texts are adequate as reference books, but not as course outlines. However, too few teachers apparently have a clear enough view of high school chemistry to write their own course outlines.

Another characteristic of high school chemistry books is their effort to put this psychological axiom into practice: to introduce the unknown through the known, through the existent experience of the student. The books have attempted to do this through the extensive applications of chemistry and the commonplace chemical items encountered in everyday life. In meetings with high school teachers of the San Francisco Bay Area, chemistry professors at the University of California at Berkeley have reacted against the textbook practice of introducing chemistry through what might be called the cold cream, hand soap, rubber tire route. This, they say, is not chemistry. Perhaps they are right, certainly if they choose to define science as does Duane Roller:[4] as applied to chemistry, it is the search for understanding of natural phenomena surrounding the transformation of elements and compounds. Roller would classify current high school texts for chemistry as technological rather than scientific*

* Roller's article reports his speech made at the National Convention of the National Science Teachers Association, Denver, Colorado, March 1958. It is a very scholarly treatment of the distinction between science and technology.

The above criticism of textbooks might suggest that the psychological axiom along with the technological approach be discarded. This would be unfortunate, for the axiom is valid and should remain. Chemistry, as genuine science, can be taught, starting with the immediate environment of the student. Chemistry had its origin in the immediate environment of the pioneer chemists, and the stimuli that set them thinking exist all around us. An illustration of how such stimuli can be used is the Atomic Theory. Something stimulated John Dalton's thinking; something caused him to project the hypothesis that particles of matter are extremely minute. Students can be urged to examine their own environment to identify phenomena that point toward Dalton's conclusions. Why can the color in a solution be uniform throughout even when the solution is subjected to extreme dilution? Does this point to large or small particles of the material imparting the color? If tissue paper is thin enough to contain 500 sheets per inch, what does this imply about the maximum dimension of a paper particle? How thick is the graphite line made by a pencil? An ink line? How thick is an oil slick on wet pavement? A soap bubble? What conclusions do these phenomena force? What experimentation can one perform with very simple equipment that would produce numerical data about the magnitude of particles?

Activities such as the foregoing are needed in greater number. They would help to make high school chemistry a genuine study of science as well as giving it an existence independent of general college chemistry.

The Teacher

In discussing the chemistry teacher, it seems more profitable to describe the ideal teacher rather than identifying characteristics of actual chemistry teachers.

The ideal chemistry teacher should have at least the equivalent of an undergraduate major in chemistry as subject-matter background and a clear knowledge of the philosophy of science. The latter knowledge could be acquired through formal courses or through independent study. It would supply him with the necessary background so that he could be an interpreter of the role of science in modern society.

In addition, he should have college training in sociology, psychology, and philosophy. These courses should be related to his intentions to be a teacher. They need not be taught in an education department, but should be an integral part of preparation for teaching. Such social science courses provide the teacher a necessary start in a lifetime study of the society in which he lives, the students he will teach, and, finally, a study of himself and the role he has chosen to play.

The education of an ideal chemistry teacher would supply him with a thorough grounding in teaching methods. He is assuming the job of trans-

mitting knowledge and understanding to others. This is not a simple task; therefore, he should be acquainted with all possible ways of doing it. As he gains experience in teaching he ought to try to make his own contributions to teaching methods through personal innovations. Examples of such innovations are the "open-ended" experiments sponsored by the Manufacturing Chemists Association[7] and new twists in the teaching of the same old thing as illustrated by the above reference to the Atomic Theory.

Other qualifications that the ideal chemistry teacher needs are sound backgrounds in the use of the English language and in the use of mathematics. He should be able to use mathematics skillfully in computation and also as a language.

The final qualification of an ideal chemistry teacher is a clear understanding of why he is teaching chemistry. This understanding would include not only his personal reasons for teaching it but why he is doing an effective job according to the demands of society and the needs of his students. This means a clear conception of the relationship between the subject, the student, society, and himself. He needs to be critical enough of his own work to appraise whether his classroom practices are accomplishing desired ends. The importance of this ability and of his ability to communicate the results of his evaluation are apparent at present when the public is expressing dissatisfaction with education.

Unfortunately few, if any, high school chemistry teachers approach the ideal described. Fortunately, programs such as those of the National Science Foundation and the Shell Foundation have been instituted in an effort to correct some of the inadequacies in teacher preparation.

Summary

In summary, what may be concluded about the teaching of chemistry in high school? Why is it being taught? What part does it play in the total education of students?

The most obvious answer is that it supplies a knowledge of the facts, principles, and generalizations that comprise the field. Taught alone, with no effort to describe this knowledge as human accomplishment, the learning of such subject matter is a dull chore. Few students are capable of sensing the beauty of chemistry as an area of intellectual accomplishment without guidance from a skilled teacher. Therefore, in addition to presenting subject matter, the teacher should be attempting to interpret chemistry as representing some of the most creative ideas of the human intellect.

Chemistry is a science and as such should provide opportunity for acquainting the student with the methods of the scientist. Such opportunities should include use of the methods in discussion, demonstration, and

laboratory sessions. In addition, students need to learn the necessary technical skills associated with chemical experimentation.

The methods of science cannot be properly understood except as one develops an understanding of science. The development of some degree of such understanding in the larger philosophical sense is a necessary objective of chemistry teaching. Such an understanding should also lead to a distinction between science and technology.

Allied with an understanding of and ability to use the methods of science is the improvement of study techniques, communication skills, computation skills, mathematical reasoning, and critical thinking. Ability to think in a critical fashion, as with the other skills listed, is not the special province of chemistry, but it is an important course objective. Many students have had no prior experience with distinguishing a laboratory observation from a conclusion based on the observation. Making such distinctions clear to students and developing the ability to distinguish for themselves is one way to encourage critical thinking.

The study of chemistry can and should be an intellectual adventure. To lift it above the level of routine study and drudgery should be the dedicated purpose of every chemistry teacher.

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LET'S LOOK AT HIGH SCHOOL BIOLOGY

BY JAMES T. ROBINSON*

Biology, as a course, entered the secondary school only a half century ago, but today about 75 per cent of high school tenth-graders are enrolled in this course. While enrollments in the physical science courses have dropped considerably, enrollments in the life sciences have steadily climbed.

Biology began, in many instances, as a semester of botany and a semester of zoology. From the very beginning, however, some teachers attempted to bring in important principles of zoology and botany, along with those from physiology and health, into an integrated program based on the major concepts of the life sciences.

In addition, many biology teachers have attempted to adapt the teaching of these principles of biology to the increasingly wider range of abilities of the students in their classes. During this same time, the growth of scientific knowledge has resulted in many additions to the scope of the biology course, until now, many teachers tend to find that they are in a race to see if they can "cover the subject matter" within the school year.

Even as adjustments are being made, critics would submit that biology today, as taught in many schools, has lost touch with recent developments in biological research. They would say that much of the content is out-of-date; that there is too much concern with "covering the ground," and not enough concern with the teaching of meaning.

Until recently, "survey courses" of subject areas in the sciences were not only common but, also, had some chance of covering the subject. Today, with scientific knowledge increasing at an exponential rate of about 6 per cent per year, surveying a field as broad as biology in a single year

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of high school is not possible. Any so-called survey course is a selection of certain facts and principles which the teacher has determined as the important ones for his group of students at this date in history.

With this continuing increase in scientific knowledge, the problem of selecting what to teach becomes more and more difficult. The tendency merely to add new knowledge to existing course structures soon becomes untenable.

The time has come to ask some pertinent questions about biology in the high school.

How does biology fit into the pattern of general education for all high school youth?

How does biology fit into the pattern of science courses designed for the education of the college-bound and the potential scientist?

Will understanding gained from a year of biology enable graduates to live more effectively in an increasingly complex, changing society?

What are teachers trying to accomplish in their year of high school biology?

Are goals for biology realistic, in terms of the available time, the students, and the social setting of each community?

Are understandings gained from research in the psychology of learning being used in the teaching of biology?

Are all objectives, or merely a few, being evaluated?

What kind of teacher-preparation is needed for effective biology teaching in the last half of the twentieth century?

Certainly those responsible for science education in a secondary school need to give thoughtful attention to questions such as these.

Although biology is now primarily a tenth-grade subject, there is a substantial trend toward placing biology in the ninth grade. This would seem to be a valid practice where a six-year program of elementary science and a two-year program of general science precedes the ninth grade. Such a ninth-grade biology course can provide students with an introduction to the laboratory, to the use of controlled experiments, and the descriptive phases of biology.

In order to provide for a maximum understanding of science in the secondary school, a planned, well-articulated and sequential program of science teaching needs to be developed. The present curriculum of general science, biology, chemistry and physics is not a sequence. These courses do not generally build one upon the other; and students can, and do many times, take only one, or two, of these courses during their high school years.

In order to function effectively in courses in contemporary biology, students need a background of many concepts in the physical sciences, as well as certain skills and understandings in mathematics. The hands of

the biology teacher are tied to description instead of analysis if the students have not developed understandings of atomic theory, including isotopes; solutions and colloidal systems; ionization; and energy transformations in chemical reactions. Students need to be able to work with elementary statistics in order to form concepts in genetics and studies of population dynamics.

With the above data in mind, it would seem that a ninth-grade exploratory course—that is, one which explores limited areas of biology from an inductive as well as deductive approach—should be followed in the tenth and eleventh grade by a two-year sequence of physical science, or physics and chemistry. In this way, a twelfth-grade course in advanced biology—which would use the concepts developed in physics, chemistry, and mathematics in the solution of biological problems—could provide a balanced program of secondary science education. This sequence would lead to reinforcement of concepts, transfer of learning to new situations, and teaching for the development of meaning.

Such a sequence of four years of science should provide an opportunity for students to develop a maximum understanding of science. Can the nation afford less than this for many of its students? Science is such an integral part of today's culture that the nation can no longer afford to have educated people who are illiterate in this fundamental area of human knowledge. Certainly, the future leaders of our nation, whether they be economists, or elementary teachers, need to be provided with a frame of reference in the sciences on which they can base their continuing self-education.

For some students, a year of biology in the ninth or tenth grade and a year of physical science in the ninth or tenth grade will provide for a minimal understanding of science in the modern world.

Within the framework of the general objectives of science education, biology has special objectives which need to be clearly understood by both teacher and students.

In the newly published *Laboratory and Field Studies in Biology: A Sourcebook for Secondary Schools*[1], two fundamental purposes of high school biology are proposed: (1) to develop an understanding of and interest in living organisms through a comprehension of important basic biological concepts, illustrated and supported by carefully selected sampling of specific factual knowledge; and (2) to develop an understanding of the scientific process and its methods of inquiry, as exemplified by the life sciences.

[1] ——, *Laboratory and Field Studies in Biology: A Sourcebook for Secondary Schools*, Publications Office, National Academy of Sciences-National Research Council, Washington 25, D.C. 1957, $7.50.

In analyzing these objectives of biology, one notes that interest is considered important, and that it is learned by the student. Thus, if a student enters biology without interest, it is the responsibility of the teacher to so structure the learning experiences that the student will learn that biology is interesting. In order to achieve this objective, the teacher must know that those learnings which are meaningful are more effective than those which lack significance to the learner. He must know that learning takes place in proportion to the involvement of the learner in the learning situation. It has been well established that when the role of the teacher is that of a guide or participant in pupil-teacher planning, learning is stimulated. It is also well known that manipulation and sensory learning are fundamental to verbal learnings, and that, if the learner accepts the objectives of the class, learning is enhanced. Thus, the teacher who wishes students to learn a process, knows that the actual performance of such a process or processes, in many situations and in many different ways, is the effective way of accomplishing this goal.

The selection of concepts poses a difficult problem if meaningful understandings of these concepts must be developed in a one-year biology course. The selection becomes much more possible of accomplishment if the sequence of science experiences is considered, such as the two years of biological and the two years of physical sciences previously described. The tendency has been to try to develop understandings of these concepts in a one-year isolated course. In such courses the result has frequently been that learnings have been verbal, superficial, and are lost to the student very shortly after the last examination in the subject.

Selected concepts from the areas of evolution, ecology, the problems of species maintenance, maintenance of the individual, and the variety of living things should make up the core of a biology course or the biological phases of a science sequence. The number of concepts to be studied would need to be determined by the student group, the kinds of materials and facilities available, and the competencies of the teacher. Certainly, a sufficient number and variety of problems, involving participation of the students, should be provided. Utilization of the laboratory in the solution of problems by means of induction is essential. Much more emphasis needs to be given to the formulation of the problem, and to hypothesis formation in the biology laboratory if the objective of teaching the methods of science is to be achieved.

One of the biggest obstacles in improving instruction is the lack of evaluative devices with which to measure the achievement of students in all of the objectives of the biology course. Published and teacher-made tests tend to evaluate only factual learning. Such tests lead students to orient their study of biology to the temporary mastery of facts. Teachers need to work toward incorporating in their tests problems which measure

the ability of students to think objectively, to analyze problems, and to demonstrate conceptual understandings in biology. As instruments to measure these outcomes are not generally available, larger school districts and schools of education need to give attention to their construction.

Indirect methods of evaluation of major objectives are possible, however. For example, the teacher and administrator can evaluate biology classes by observing the degree to which pupils are participating in the learning process. As the days and weeks of the school year go by, the teacher can ask, "How much time are the students actively engaged in meaningful experiences?" As he observes students in action in the classroom, he can determine his students' level of understanding by asking the question, "Why?" He can ask: "Are my students increasing in their interest in biology?" "Are students doing more leisure reading in the areas of biology and the other sciences?" Through these and other similar questions, the teacher can evaluate his own effectiveness.

This discussion of evaluation leads to the problem of the kind of teacher needed for an effective program of education in biology in the secondary school. First, as indicated earlier in this article, the teacher needs to have preparation in both physical and biological sciences. Without such a foundation, it will be very difficult to present a program in modern biology. Such a thorough academic preparation is a necessary, but certainly not sufficient, background for teaching. In addition, the teacher needs to have conceptual understanding of the major areas of biology, so that he may be in a position to choose wisely those concepts which will be most appropriate for his students in his particular community. In addition, as already noted, the teacher needs to have a thorough understanding of the learning process and the characteristics of his learners. These understandings cannot be verbal but must have become integrated into the teacher's behavior.

Administrators can help improve the biology curriculums in many ways. They can examine the demands being placed on teachers which tend to pull them away from the instructional program. They can evaluate the manner in which the teacher's time is being used so that consideration can be given to supplying teachers with mechanical aids or technical assistants. Improvement of the learning experiences of students could be greatly enhanced by relieving the teacher of some of the problems of maintaining an effective laboratory program through the employment of laboratory assistants.

In order to achieve a re-orientation of secondary school biology, administrators needs to provide the intellectual climate, and the time necessary for teachers to participate in study and development of the curriculum.

ARTICULATION IN SCIENCE

BY KEITH SMITH*

Science education in elementary and secondary public schools is at present in the bright limelight. Technological achievements, such as the successful launching of Sputniks and Explorers and the polar passage of the nuclear powered "Nautilus," have focused public attention on science education. However, the real issues of science education pre-date these spectacular events.

Public schools in America exist in a society from which they derive guidance and direction. They are charged with the responsibility of transmitting and interpreting the heritage of a race. Furthermore, society expects the schools to improve the culture in the process. As the sharp criticism and raw comparisons between education in the United States and Russia die down in the post-Sputnik era, it is well to take a longer look at the development of science in public school education in order to gain a balanced perspective. The need for *quality* in *quantity* has been developing for a long time. A scientifically based culture is critically demanding.

As the understanding of science has grown, it has come to occupy a greater and greater part of our culture. An increasingly complex technology, using more and more of the principles of science, has produced in the United States a social order enjoying the highest physical standards of living known in the history of civilization. To maintain this civilization great quantities of energy are required and no small amount of technical and scientific knowledge must be transmitted to each oncoming generation. However, a healthy civilization is not static. To remain healthy it must grow. The food for growth in a society dependent upon technology is derived from pure scientific research. It is from the developments of

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such research that applied science and engineering are able to cope with the increasing demands of a highly complex society.

It is natural that citizens regard their public school system critically. It is reasonable that careful appraisal be made of the place of science in elementary and secondary education. The question may be legitimately raised as to whether the American school has given sufficient attention to science as a part of general education. Do the courses offered provide pupils with a proper sequence of experiences which will meet the demands of a society which requires literacy and proficiency in science?

What science is now offered in the public schools of today? Nearly all American high schools follow a single theme of science courses; general science in grade nine, biology in grade ten, chemistry in grade eleven, and physics in grade twelve. Ninth-grade general science does not generally take note of any science the pupil may previously have learned, either in the elementary school or on his own. Brandwein[1] reports that most school systems in the country have planned or are planning a general science experience in the junior high school years, grades seven, eight, nine. The writer[2] found in a study of 100 junior high schools a definite trend toward increasing the number of minutes per period for general science classes. There is also a trend for school systems to treat general science as an extension of the elementary program in grades one through six. There is not now, however, a clearly defined pattern of course content constituting general science.

Many writers see science as a development which serves to link history, literature, and geography in a manner to provide perspective to non-scientists. Schools are urged to teach science not as a collection of facts but as an evolution of knowledge. By understanding the evolution of science, the pupil comes to understand the heart of the scientific method. The pupil is provided with problems appropriate to his maturity level. He is encouraged to collect data, make inductions, draw conclusions and from the conclusions, put deductions to the test and on the results of the test, undertake new inductions. Unless boys and girls are permitted to perform some small bit of research, understandings of the logical and empirical aspects of the scientific method will remain forever outside of their experience.

Looking toward the future, it is reasonable to expect more school systems will require of all pupils some science each year from the primary grade through grade ten. As the amount of science experience increases,

[1] Brandwein, Paul, "Trends in High School General Science, Science in Secondary Schools Today," *Bulletin* of the National Association of Secondary School Principals, **34:** 50–55, January 1953.

[2] Smith, Keith, "Trends in Junior High General Science," *The Science Teacher*, **23:** 2, March 1956.

a re-evaluation of the ninth-grade offering and the reorganization of the ninth-grade program becomes essential. It becomes increasingly important for ninth-grade teachers to know the kind of experience pupils have had in previous grades.

Indeed, one may say that if pupils are to derive lasting understanding of science, a well-correlated program incorporating sequential experiences in both physical and life science should prevail from kindergarten through the secondary level at least.

The brain power of a nation is its greatest asset. Studies reveal that many able pupils fail either to finish high school or go on to college. This attrition is exceedingly costly to the nation. The contributing causes are many, ranging from simple to complex. Schools alone cannot correct the situation. However, they may contribute positively to the production of more scientists and engineers. This may be done by early identification and encouragement of those with potential abilities, and by providing a well-articulated curriculum. Studies show that many young people decide on a career, in science or other fields, while they are still in the elementary grades. Obviously, the earlier the future scientist and engineer can be identified, the easier it is to plan a program which will provide intellectual and emotional satisfaction for him. Many forces at work in the high school of today are moving in the direction of an integrated science program.

The sequence and articulation of science in the junior and senior high school have evolved historically in separate compartments called general science, biology or life science, chemistry and physics. These subjects are usually taught in the above order without much sensible recognition of their fundamental interrelationship. There are, however, activities in progress which indicate trends toward treating science as an integrated subject. Throughout the United States the science fairs, sponsored by the Science Clubs of America, provide junior and senior high school pupils excellent opportunity for studying science through projects. In many communities men of industry and business have contributed money, time, and material assistance in co-sponsoring local and regional science fairs. The response has been phenomenal. While the projects are classified according to grade level and a particular branch of science, the pupil, in completing his project, must broaden his knowledge in various fields of science. This affords the science teacher a wonderful opportunity for encouraging pupils to learn more about all sciences.

A most interesting cooperative movement has developed in Los Angeles and, more recently, in the entire southern California region. It began with the interest of the Los Angeles Chapter of the American Engineering Society in counseling pre-engineering pupils and later spread to the Los Angeles Technical Societies. These efforts finally merged into

The Southern California Industry-Education Council which fosters cooperation between industries and the schools. Two major activities may be described under the headings: "Industry in Education Program" and "Education in Industry Program."

The "Industry in Education Program" provides valuable supplementary assistance to the science teacher at various grade levels. Teams of scientists and engineers from industry present lecture-demonstrations directly to science classes. So that the work of the scientists may be properly timed and integrated with the regular teaching program, they meet with the science teacher and the science supervisors at the beginning of the semester. Results show that the work of the teacher is strengthened when the scientist, who speaks with authority, demonstrates and discusses his own use of the same fundamentals of science which have been presented to the class by the teacher. As an added motivation, the scientist is often able to bring to the classroom for demonstration, materials and equipment which are not readily available to the teacher.

The "Education in Industry Program" has provided summer opportunities for science and mathematics teachers to work professionally in scientifically-based industries. Special effort has been made to give teachers so employed an extensive orientation to the uses of science and technology by industry. These teachers are therefore able to bring back to their classrooms a better background of experience with which to enrich their classroom activities. Teachers with these experiences report that as they develop more interesting patterns of instruction and demand more rigorous work of their pupils, the pupils respond with intensified study and enthusiasm.

One responsibility of the schools is to provide challenging lessons for the more gifted pupils. In Los Angeles, special classes have been developed for pupils who are gifted in science and mathematics. In some schools, pupils who possess high level ability and achievement in school and a special interest in science are being invited to enroll in science laboratory courses in summer school. Each course operates for four hours from 8 a.m. to 12 noon. Enrollment is limited and outstanding teachers are selected to instruct. The four-hour class provides ample opportunity for study, discussion, laboratory activities, and projects covering various aspects of science not ordinarily covered in the regular science program. The instructor may also call on scientific personnel from industry to assist in the enrichment of the program.

All of the projects and developments here mentioned were initiated prior to the advent of Sputnik I. The effects of these forces will continue to adapt, integrate, and articulate science education to the educational needs of society long after the beeps of the first Sputniks have spent themselves in the vastness of space and time.

NEW PUBLICATIONS

Current Books and other materials recently received in the *Journal* office:

Educating Citizens for Democracy: Curriculum and Instruction in Secondary Social Studies. Edited by Richard E. Gross and Leslie D. Zeleny. New York: Oxford University Press, 1958. vi + 591 pp. $6.00.

Guidance Aids for a Stronger America. Prepared for the Illinois Curriculum Program—Aviation Education Project by Harry D. Lovelass. Copies obtainable from National Aviation Education Council, Washington, D.C. 83 pp. 75 cents.

Hunt, Herold C. and Pierce, Paul R. *The Practice of School Administration.* Boston: Houghton Mifflin Company, 1958. x + 544 pp. $6.00.

Miller, William. *A History of the United States.* New York: Dell Publishing Co., Inc. 1958. 512 pp. 75 cents.

Nason, Leslie J. *Academic Achievement of Gifted School Students.* Los Angeles: University of Southern California Press, 1958. xv + 92 pp. $3.95.

Sechrest, Carolyn A. *New Dimensions in Counseling Students.* New York: Bureau of Publications, Teachers College, Columbia University, 1958. viii + 119 pp. $3.00.

Strom, Ingrid M. *The Role of Literature in the Core Curriculum.* Bloomington: Indiana University, 1958. 60 pp. $1.00.

Teacher's Guide to Physical Education for Girls in High School. Compiled by Genevieve Dexter. Sacramento: California State Department of Education, 1957, xix + 329 pp.

Teaching Foreign Relations. A guide to be used in conjunction with the North Central Association's Foreign Relations Project. Revised edition. Science Research Associates, 1957. 24 pp. Middle East Supplement, 1958. 7 pp. Experimental Edition. Free.

Venable, Tom C. *Patterns in Secondary School Curriculum.* New York: Harper and Brothers, 1958. xii + 236 pp. $3.00.

White, Verna. *Studying the Individual Pupil.* New York: Harper and Brothers, 1958. xvi + 239 pp. $4.00.

Wiggins, Sam P. *Successful High School Teaching.* Boston: Houghton Mifflin Company, 1958. xii + 379 pp. $5.00.

Williams, Joseph E. *The Prentice-Hall World Atlas.* New York: Prentice-Hall, Inc., 1958. 1st edition. 96 + 25 pp. index. $5.26.

45 MILLION IN SCHOOL

Just as they did last year, schools and colleges this year enrolled one out of every four Americans. But in the total count of pupils and students—the count that really matters when it comes to providing classrooms and teachers—this year's figures aren't the same at all. Enrollments are expected to surge upward by approximately 1¾ million to a grand total of 45 million—the latest in a series of increases that has been uninterrupted for fourteen years.

At all levels schools expect record attendance. Again, the largest enrollment will be in the grades K–8: 31,793,000, or 1,123,000 over last year's estimate. School attendance in grades 9–12 will increase by nearly half a million (456,000) to total 8,880,000 students. Colleges anticipate an increase of 173,000 pushing enrollments to 3,623,000.

Estimated Enrollments in Educational Institutions in the Continental United States for 1957–58 and 1958–59

School	*1957–58*	*1958–59*
Kindergarten through grade 8:		
Public school system	26,037,000	26,927,000
Nonpublic schools	4,466,000	4,693,000
Federal schools for Indians	26,000	25,000
Federal schools under Public Law 874	[1] 20,000	20,000
Other	[2] 121,000	128,000
Total kindergarten through grade 8	30,670,000	31,793,000
Grades 9–12:		
Public school system	7,399,000	7,790,000
Private and parochial schools	942,000	1,002,000
Federal schools for Indians	11,000	11,000
Federal schools under Public Law 874	[1] 1,000	1,000
Other	[2] 71,000	76,000
Total grades 9–12	8,424,000	8,880,000
Total elementary and secondary	39,094,000	40,673,000
Higher education:		
Universities, colleges, professional schools, including junior colleges, normal schools, and technical schools	3,450,000	3,623,000
Other schools:		
Private commercial schools (day and evening)	560,000	560,000
Nurse training schools (not affiliated with colleges and universities)	91,000	89,000
Total other schools	651,000	649,000
Grand total	43,195,000	44,945,000

[1] Includes only "schools operated on post by Federal Agency."

[2] Includes residential schools for exceptional children and model and practice schools in teacher training institutions.

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The Office of Education notes that at least eighty public schools in twenty-five States and the District of Columbia, and seventeen private schools, are offering Russian this fall. Last year only eight public and ten private schools taught it.

Russian studies are also increasing in colleges and universities. Many of the 175 institutions already teaching Russian are expanding their programs; about a dozen others are beginning Russian this fall. During the summer sixteen universities held classes or workshops for teachers.

Graduate literature and language courses are offered at thirteen colleges.

Five cities are providing television courses in scientific Russian.

—School Life, September 1958

TEACHERS

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